in April. The equalizing influence of the increased moisture is shewn by the increase of the temperature at the fourth plantation, while it has reduced the great heat of the air at the fifth plantation as shown by the maximum and mean temperatures for April and May, and it has raised the mean minimum temperature of May by nine-tenths of a degree.

2. These changes in the temperature and moisture of the air and the increased rainfall during the month have favored the growth of all the species of Cinchona.

The increased vigor of the plants was however noticed only from the third plantation downwards, as the two upper plantations, have not yet experienced the full force of the warm rain with which Sikhim is deluged from the 1st of June until the end of the rainy season.

3. The monthly growth as indicated by the record of carefully measured plants is perhaps best shewn in a Tabular Statement of the greatest and least growth of each species at the different heights:—

Table shewing the maximum and minimum growth of species of Cinchona during May at five different altitudes.

Name of Species.	First Plantation, maximum and minimum growth.	Second Plantation, maximum and minimum growth.	Third Plantation, maximum and minimum growth.	Fourth Plantation, maximum and minimum growth.	Fifth Plantation, maximum and minimum growth.
C. Succirubra ...	...	...	...	1½ to 4½ inches.	1¼ to 6 inches.
C. Micrantha ...	...	...	...	1½ to 5¼ „	4 to 10¼ „
C. Officinalis ...	½ to 1 inch.	¼ to 1¼ inch.	1½ to 2¼ inches.	1½ to 8 „	1 to 6 „
C. Pahudiana ...	¼ to ¾ „	2 inches.	1¼ to 4¾ „	1¼ to 7½ „	1⅜ to 7¼ „

The greatest growth during the month among the measured plants occurred in a fine plant of *Cinchona Micrantha* at the lowest plantation where this species is in the most perfect health. The most vigorous growth in *Cinchona Succirubra* is also at this plantation. *Cinchona Officinalis* however grows faster and is healthier in the cooler air of the fourth plantation.

4. The stock plants continue to grow well, and although they do not give the same amount of cuttings that could be obtained if the plants were grown under the protection of glass still the cuttings are vigorous and healthy.

The number of cuttings made during the month was 6,071.

5. The cuttings made during April 12,104 have all made roots, but for want of room they have been kept in the cutting beds. The total number of plants and partially rooted cuttings was on the 31st May 55,557.

Number and distribution of Cinchona plants in the Government Plantation at Darjeeling, 1st June 1865.

Name of Species of Cinchona.	Number in permanent plantation.	Number of stock plants for propagation.	Number of seedlings or rooted cuttings in nursery beds for permanent plantation.	Number of rooted cuttings in cutting beds.	Number of cuttings made during the month.	Total number of plants, cuttings, and seedlings.
C. Succirubra ...	389	4,391	None	6,070	3,500	14,350
C. Calisaya ...	None	23	...	38	None	61
C. Micrantha ...	15	929	...	610	450	2,004
C. Officinalis, including varieties...	690	18,639	...	12,600	2,121	34,050
C. Pahudiana ...	2 162	None	2,930	None	None	5,092
Total ...	3,256	23,982	2,930	19,318	6,071	55,557

TABLE shewing the growth of Cinchona at the Runghee Plantation near Darjeeling during May 1865.

Name.	Number.	1st Plantation, Altitude 5,500 feet.					2nd Plantation, Altitude 4,350 feet.					3rd Plantation, Altitude 3,715 feet.					4th Plantation, Altitude 2,500 feet.					5th Plantation, Altitude 1,825 feet.				
		Date of planting.	Height in inches when planted.	Height on 1st May.	Height on 1st June.	Growth in May.	Date of planting.	Height in inches when planted.	Height on 1st May.	Height on 1st June.	Growth in May.	Date of planting.	Height in inches when planted.	Height on 1st May.	Height on 1st June.	Growth n May.	Date of planting.	Height in inches when planted.	Height on 1st May.	Height on 1st June.	Growth in May.	Date of planting.	Height in inches when planted.	Height on 1st May.	Height on 1st June.	Growth in May.
		1864.					1864.																		
C. Succirubra	1	.....	...	...	...	...	.....	...	...	...	...	29th June..	18½	23	24	1	29th July...	5	12	12	...	29th July...	6	30	32½	2½
Ditto ...	2	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	17½	23¾	23¼	...	29th „ ...	6	16½	16½	...	15th Oct. ...	10½	16¼	19½	3¼
Ditto ...	3	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	16	21½	22½	0½	29th „ ...	7½	13¼	16¾	3½	29th July...	3½	10½	10½	...
Ditto ...	4	.....	...	...	...	...	.....	...	...	...	...	29th July...	6	10¾	11¾	1	15th Oct. ...	10	12½	12½	...	29th „ ...	3½	13½	13½	...
Ditto ...	5	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	6	15¼	15½	0¼	29th July...	4½	9½	9½	...	29th „ ...	5½	20¾	24½	3¾
Ditto ...	6	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	4½	11¾	13¼	1½	29th „ ...	3	18	24	6
Ditto ...	7	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	3½	11½	11½	...	29th „ ...	4	15½	15½	...
Ditto ...	8	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	2	8½	8½	...	29th „ ...	4½	17¼	22¼	5
Ditto ...	9	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	3	11	13¾	2¾	29th „ ...	4	19¾	25	5¼
Ditto ...	10	.....	...	...	...	...	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	3	13¼	17¾	4½	29th „ ...	3	14¼	15½	1¼
C. Micrantha	1	.....	...	...	...	...	.....	...	...	...	...	29th July...	5	8½	8½	...	15th Oct. ...	9	9¾	15	5½	29th „ ...	5½	21¼	31½	10¼
Ditto ...	2	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	7½	11¼	11¼	...	15th „ ...	6½	7¼	9	1¾	29th „ ...	6	15	19	4
Ditto ...	3	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	6	10¾	10¾	...	29th July...	3	9¼	12¼	3	15th Oct. ...	6	6¼	6¼	...
Ditto ...	4	.....	...	...	...	...	.....	...	...	...	...	29th „ ...	5	7	7	...	29th „ ...	2½	6¼	7¾	1½	29th July...	4½	8½	8½	...
Ditto ...	5	.....	...	...	...	...	.....	...	...	...	...	25th „ ...	5½	9	9	...	29th „ ...	3	11	13	2	15th Oct. ...	5½	11	11	...
C. Officinalis	1	15th Dec. ...	8¼	10¾	10½	...	15th Dec. ...	8½	12	12¼	0¼	4th „ ...	8½	13¾	13¾	...	15th Oct. ...	4	10½	16½	6	15th „ ...	5	6	6	...
Ditto ...	2	15th „ ...	7¼	7¼	7¾	...	15th „ ...	11½	13½	13½	...	15th Oct. ...	6	10	10	...	15th „ ...	5½	8½	12	3½	15th „ ...	4½	17½	24	6½
Ditto ...	3	15th „ ...	6½	7¾	7¾	...	15th „ ...	6½	7	8¼	1¼	15th „ ...	5	8	8	...	15th „ ...	4½	7½	9	1½	15th „ ...	5	12¼	15½	3
Ditto ...	4	15th „ ...	6½	6¾	7	0½	15th „ ...	6	7	8	1	15th „ ...	5	6¾	6¾	...	15th „ ...	5½	12¼	19¼	7	15th „ ...	4	13	17¾	4¾
Ditto ...	5	15th „ ...	5¼	5¾	5¾	...	15th „ ...	7	9½	10¾	1¼	15th „ ...	5	8¼	8¼	...	15th „ ...	5	12	19½	7½	15th „ ...	6	11¾	16¼	4¾
Ditto ...	6	15th „ ...	5¼	6	6½	0½	15th „ ...	6½	9	9	...	15th „ ...	5½	7¼	7¼	...	15th „ ...	4½	15	23	8	15th „ ...	4½	8½	8¼	...
Ditto ...	7	15th „ ...	5	5¼	6¼	1	15th „ ...	6	9½	10¾	1¼	15th „ ...	4	6¼	8½	2¼	15th „ ...	5½	7	7	...	15th „ ...	5	15	15	...
Ditto ...	8	15th „ ...	4	4	4	...	15th „ ...	7¼	10¼	11¼	1	15th „ ...	5	6½	6½	...	15th „ ...	4½	6	9¼	3¼	15th „ ...	5½	7¾	7¾	...
Ditto ...	9	15th „ ...	4½	5	5½	0½	15th „ ...	7	11¼	12½	1¼	15th „ ...	6	8	8	...	15th „ ...	4	13	20	7	15th „ ...	4	7¼	8¼	1
Ditto ...	10	15th „ ...	10	12½	13½	1	15th „ ...	7½	7¾	8¾	0¾	15th „ ...	5½	7¾	9	1½	15th „ ...	3	8¼	14	5¾	15th „ ...	4½	12½	12½	...
C. Pahudiana	1	15th „ ...	5	5½	5¾	0¼	15th „ ...	5	6	6	...	4th July...	5	9½	14¼	4¾	15th „ ...	7½	9	12¼	3¼	15th „ ...	7½	9¾	9¾	...
Ditto ...	2	28th Mar./65	5	5¾	5¾	...	15th „ ...	4	4½	4½	...	4th „ ...	5½	12½	14¾	2¼	15th „ ...	4½	7½	9	1½	29th July...	1½	6	6	...
Ditto ...	3	28th „ „	5	5¼	6	0¾	15th „ ...	4½	4½	4½	...	4th „ ...	3	9½	11¼	1¾	29th „ ...	3	12	19½	7½	29th „ ...	2	15¾	19½	3¾
Ditto ...	4	15th Dec./64	2½	3	3	...	15th „ ...	5	5	5	...	4th „ ...	2	6¾	6½	...	29th „ ...	3	11¾	16	4¼	29th „ ...	3	14¾	22	7¼
Ditto ...	5	15th „ „	2¾	4¼	4¾	0½	15th „ ...	5	5	5	...	4th „ ...	3	6	6	...	29th „ ...	3	6½	10¼	3¾	29th „ ...	2½	6½	6½	...
Ditto ...	6	15th „ „	2½	3¼	3¾	...	15th „ ...	5½	6½	8½	2	4th „ ...	3	9½	13½	4	29th „ ...	3	7¼	10	2¾	29th „ ...	1½	10¾	17½	6¾
Ditto ...	7	28th Mar./65	3¼	5	5	...	15th „ ...	4½	5	5	...	4th „ ...	2	10	11¼	1¼	29th „ ...	3	10	15	5	29th „ ...	2	16½	19½	3
Ditto ...	8	15th Dec./64	2¾	2¾	2¾	...	15th „ ...	5½	7	7	...	4th „ ...	2½	8	8	...	29th „ ...	3½	6¾	9½	2¾	29th „ ...	2½	4¼	4¼	...
Ditto ...	9	15th „ „	4¼	4½	4½	...	15th „ ...	2¾	3	3	...	4th „ ...	2½	12½	12½	...	29th „ ...	3	9	10¼	1¼	29th „ ...	1½	13	17½	4½
Ditto ...	10	15th „ „	2¾	3	3	...	15th „ ...	3½	4	4	...	4th „ ...	3	11¼	14	2¾	29th „ ...	3	8¼	10	1¾	29th „ ...	4	10½	12	1½

Darjeeling,
The 1st June 1865.

T. Anderson, M. D.,
Superintendent, Botanical Gardens, and in charge of Cinchonæ Cultivation in Bengal.

Printed by Thomas Jones, at the Bengal Secretariat Office.

No. 29 [365]

SUPPLEMENT TO

The Calcutta Gazette.

WEDNESDAY, AUGUST 16, 1865.

OFFICIAL PAPERS.

A SUPPLEMENT *to the* GAZETTE *will henceforward be published, containing such Official Papers and Information as the Government of Bengal may deem to be of interest to the Public, and such as may usefully be made known.*

Non-Subscribers to the GAZETTE *may receive the* SUPPLEMENT *separately on a payment of six Rupees per annum if delivered in Calcutta, or twelve Rupees if sent by Post.*

No Official Orders or Notifications, the publication of which in the GAZETTE *is required by Law, or which it has been customary to publish in the* GAZETTE, *will be included in the* SUPPLEMENT. *For such Orders and Notifications the body of the* GAZETTE *must be looked to as heretofore.*

Report on the Project of the Salt Water Lakes' Reclamation and Irrigation Company, "Limited."

From the President and Members of the Commission appointed to enquire into the projects of the Salt Water Lakes' Reclamation and Irrigation Company, "Limited," to the Secretary to the Government of Bengal, Public Works Department,—(dated the 22nd July 1865.)

THE Commission formed of the Members as per margin and appointed, under Act XXII. of 1863 by a Notification No. 153A., dated 17th April 1865, from Government of Bengal, for the purpose of enquiring into the project of the Salt Water Lakes Reclamation and Irrigation Company, "Limited," submit the following report in accordance with the instructions received from His Honor the Lieutenant-Governor of Bengal in a letter, No. 1972, dated 17th April 1865, from the Secretary to the Government of Bengal in the Public Works Department.

President:
H. L. Dampier, Esq., C.S., Commissioner of the Nuddea Division.

Members:
W. Smith, Esq., C. E., Officiating Superintending Engineer, South-Eastern Circle.
J. Fawcus, Esq., M. D.

2. On receipt of these instructions the Commission published a notice in the *Calcutta Gazette* and Daily Papers inviting parties interested in the Reclamation project to make any representation they had to offer on the subject before 15th May 1865.

3. Only one such representation containing an objection to the carrying out of the project was received by the Commission: this was made by Dr. S. Goodeve Chuckerbutty.

One objection to the project received.

4. The Commission held seven meetings, and examined the following witnesses:—

Meetings held by Commission and evidence taken.

Mr. G. Anley, Officiating Engineer to the Calcutta Justices.

Mr. F. Prestage, Agent, Eastern Bengal Railway.

Mr. J. O'Flaherty, Executive Engineer, Calcutta Canals, and Dr. S. Goodeve Chuckerbutty.

5. The Commission also visited the Salt Lakes.

6. The present levels of the Salt Water Lakes and the two navigation channels have been tested at the instance of the Commission and found correct, and four cross sections of the central channel have been taken to ascertain its present capacity.

Levels of the Salt Water Lakes tested.

7. The following papers connected with the proceedings of the Commission are annexed:—

I. Memorandum No. 3259, dated 27th April 1865, from Superintending Engineer, South-Eastern Circle, to the Executive Engineer, Calcutta Canals.

II. Reply No. A., dated 20th May 1865, from Executive Engineer, Calcutta Canals, to Superintending Engineer, South-Eastern Circle, with enclosures as follows:—

One sheet of four sections of Central Channel Lake.

One Guage Statement shewing comparative levels of Salt Water Lakes as taken by various Officers.

III. Demi-official Note, dated 20th June 1865, from Superintending Engineer, South-Eastern Circle, to J. O'Flaherty, Esq., regarding levels of Tolly's Nullah, and his reply dated 28th June 1865.

IV. Letter addressed by the President of the Commission to the Chairman of the Calcutta Justices dated 1st June, No. 14.

V. Reply of the Chairman dated 5th June, No. 477.

VI. Evidence of G. Anley, Esq., C. E., Officiating Engineer to the Justices of the Peace for Calcutta.

VII. Evidence of F. Prestage, Esq., Agent to Eastern Bengal Railway Company, given on 1st June 1865.

VIII. Evidence of J. O'Flaherty, Esq., C. E., Executive Engineer, Calcutta Canals' Division, given on 5th June 1865.

IX. Evidence of Dr. S. Goodeve Chuckerbutty given on the 12th June 1865, with Notes appended.

MAPS.

X. Outline trace from a map of part of the Revenue Survey of the Calcutta land supposed to be surveyed by Captain Claud Martin in 1760 or 1764.

XI. Map of the Salt Water Lake, Tardah Jungle and the surrounding lands specially compiled for the use of the Salt Water Lakes Reclamation and Irrigation Company, "Limited," at the Office of the Surveyor-General of India—1865.

XII. Map of the land applied for by the Salt Water Lakes Company, "Limited," by Mr. Heysham, shewing roughly the villages falling within the area and the present state of the lands.

8. The following papers have been referred to by the Commission:—

I. Minute by Lord W. C. Bentinck, K. C. B., Governor General, dated 2nd February 1830, on the subject of draining the Salt Water Lake, &c., pages 1 to 5, Appendix G., to Report of Committee upon the Fever Hospital.

II. Survey of the Salt Lakes or marshes adjoining Calcutta by Captain T. Prinsep, dated December 1828.

III. Map of the Suburbs of Calcutta, east of the Circular Road, from Barripore to Ballygunge, including Dum-Dum, the Eastern Canal, and the Salt Water Lake, &c., with a guage of levels by Captain T. Prinsep, Engineer, late Superintendent of Canals—1830.

(These two maps face page 6, Appendix G.)

IV. Captain Prinsep's answers to questions put by Governor General, pages 6 to 12, Appendix G.

V. Printed Table exhibiting a daily register of the tides in the River Hooghly at Calcutta from 1805 to 1828 by James Kyd, Esq., pages 13 to 16, and Diagram, Appendix G.

VI. Captain Prinsep's Memorandum and Diagram on Tolly's Nullah, page 17, and Diagram facing it in Appendix G.

VII. Captain Prinsep's Memorandum on the Salt Water Lakes, pages 17 to 26, Appendix G.

VIII. Letter of W. Dampier, Esq., Commissioner in the Soonderbuns, dated 13th January 1830, relating to the extent of the Lake and average rent per beegah for lands in its vicinity, page 26, Appendix G.

IX. Extract from the Hon'ble Court of Directors' letter dated 10th November 1830, replying to the Governor General's Minute dated 2nd February 1830, page 28, Appendix G.

X. Minute by Sir Thomas Anbury, C. B., Chief Engineer, submitted by him to the Governor General (it is believed in December 1833) on the Salt Water Lakes, with a plan for filling them up, pages 33 to 36, Appendix G.

XI. A paper by late Major J. A. Schalch, shewing method employed to ascertain the difference of level between the Hooghly and Salt Lake, marked D. 1, page 25 of Appendix to Appendix G.

XII. Dr. Duncan Stewart's evidence before Municipal Enquiry Committee on 28th July 1836, entitled "Historical Notices," pages 135 to 138, Appendix D., of evidence taken by second Sub-Committee upon the Fever Hospital.

XIII. Indenture between Warren Hastings, Esq., Governor General of Bengal, and Major William Tolly, dated 4th September 1777, for the excavation of Tolly's Nullah, page 14 of Appendix to Appendix J., volume VI., Municipal Reports.

XIV. Statement of boats passed through Tolly's Nullah and tolls levied thereon from 1st May 1819 to 30th April 1822, dated Collector's Cutcherry, 24-Pergunnahs, 24th December 1822, page 242 of Appendix to Appendix G.

XV. Ditto of boats passed through Eastern Canal at Balliaghatta during same period, page 243 of Appendix to Appendix G.

XVI. Report of the Committee on drainage of Calcutta in 1857, pages 5 and 6, and Appendix No. III. on Salt Water Lake. Tidal observations at Dhappa during 1856, pages 19 to 32 of Appendix No. VI.

XVII. General Register of Tide commencing from 4th September 1857 at Dhappa taken by the Engineer to the Calcutta Municipality. (This belongs to the Calcutta Justices.)

Division of the subject into heads.

9. The Commission will deal with the subject under the following heads:—

I. A review of the past condition of the Salt Water Lakes and the occurrences in relation thereto contrasted with their present state.

II. The present project viewed in relation to the Calcutta Drainage Scheme.

III. The same in relation to the navigation channels running through the Salt Water Lakes.

IV. On the area proposed to be included in the operations, and estimated cost of purchase.

V. On the disposal and utilization of the sewage in the manner proposed by the Company, considered both from a sanitary and agricultural point of view.

VI. The estimated cost of the works.

VII. Financial prospects of the undertaking.

VIII. Consideration of the sanitary effect on Calcutta to be expected from the proposed mode of reclamation.

IX. Recommendations of the Commission as to conditions to be imposed.

FIRST SECTION.

A review of the past condition of the Salt Water Lakes and the occurrences in relation thereto contrasted with their present state.

1. The oldest record of the Salt Water Lakes which the Commission have seen is a map (at present in the Surveyor-General's Office) of the "Revenue Surveyor of the Calcutta land supposed to be surveyed by Captain Claud Martin in 1760 or 1764." It is on a scale of one mile to an inch, and the relative positions of the Hooghly, Fort, Town, and such out-lying places as Gurreah and Barripore to the south-east are shewn with tolerable accuracy: unfortunately the map is incomplete, for the northern extremity of the Lakes and Dum-Dum are not to be seen. On this map the Lakes are shewn in two distinct Divisions east and west, with an intervening ridge and a channel connecting them. The western portion is, however, much more contracted and further from Calcutta than at the present day, and no reliance can be placed upon its accuracy in this respect. The map shews that a century ago no communication whatever existed between these Lakes and the Hooghly.

Old Map of 1760 or 1764 by Captain Claud Martin.

2. The first communication between the Salt Lakes and the Hooghly was effected by Major W. Tolly under the terms of a contract made with Government in 1777, and is consisted in excavating a canal from one of the natural channels at southern ends of the Lakes near Gurreah to the khall, which flowed by Allipore and Kidderpore into the

Tolly's Nullah.

Hooghly: this communication now goes by the name of Tolly's Nullah, and measured from the Hooghly at Hastings' Bridge to Samookpotta, where it joins the central channel through the Lakes and falls into the Biddiadhurry River, it is 17 miles in length.

3. This communication practically established the fact of the great difference between the levels of the River Hooghly and those of the Salt Water Lakes, and as the tidal flow throgh it is not checked by locks, it became necessary to embank the sides of the channel below Gurreah. From observations taken half a century after its construction, the high water surface of the Hooghly in September 1826 was found to be 8-8 higher than that of the Canal at Gurreah.

Balliaghatta Canal.

4. In 1810 the Balliaghatta Canal was cut, uniting the north-western extremity of the Lakes with Entally for the convenience of boat traffic.

Lord W Bentinck's Minute, dated 2nd February 1830, recommending the drainage and embankment of the Salt Water Lakes.

5. But it was not till 1830 that any definite measures appear to have been taken with reference to the Salt Lakes. In that year Lord William Bentinck, then Governor General, took up the subject of the Lake reclamation on sanitary grounds, and in a Minute, dated 2nd February 1830, strongly recommended its being drained and embanked. In this valuable document His Lordship refers to several papers drawn up at his instance, and throwing light upon the then state of the Lakes and their levels in relation to that of the River Hooghly: His Lordship's views derive additional authority from his practical experience of fourteen years as a Commissioner of Drainage in the Fens of Lincolnshire.

6. These proposals though recognized and highly approved by the Court of Directors were not carried out, doubtless, from more urgent affairs requiring attention and the difficulty of providing the necessary funds.

7. The condition of the Salt Lakes up to, and at, that period was in a sanitary view as bad as it could be.

Captain Hamilton's account of Calcutta and its vicinity in 1706 cited by Dr. Duncan Stewart in 1836.

8. In Dr. Duncan Stewart's evidence during the Municipal enquiry of 1836, he refers to the statement of Captain Hamilton as the earliest authentic English account of Calcutta and its vicinity. Captain Hamilton, according to Dr. Stewart, visited Calcutta in 1706, and he described the position of the town as follows:—

His description of the Salt Water Lakes.

"Mr. Charnock could not have chosen a more "unhealthy situation on all the "line of river, for three miles "to the eastward is a Salt Water Lake, "which overflows in September and October "and prodigious numbers of fish resort "there; but in November and December "when the floods are dissipated those fishes "are left to die, and with their putrefaction "affect the air with thick stinking vapours, "which the north-east winds bring with "them to Fort William, so that a great "yearly mortality is caused by them."

Dr. Stewart states the Lake was much nearer to Calcutta forty years before his time.

In another place Dr. Stewart states: "not "more than forty years ago "the Salt Water Lake was "much nearer to Calcutta "than at present. At a "village called Ramkissenpore, a mile from "the high road leading to Dum-Dum, is a "mound or tumulus of about 30 feet in "height surrounded by two venerable peepul "trees, from either of which, if ascended by "help of a ladder, a magnificent view of "the surrounding country and of the Lakes "whole expanse may be had. This mound, "which retains its native name of Dum-"Dumma, not forty years ago, was on the edge "of the Lake: it is said to have been raised "by the Burmese or Mug Traders who "frequented the Port and used to anchor "their boats at this place. The Lake has "now receded nearly a mile from its foot, "and the whole circumference has been "gradually contracting in a similar way for "many years. The present area of both "Lakes comprises a surface of about 17,000 "acres or about 26 square miles."

"The western or proper Lake is traversed in "a diagonal direction about five miles by a "navigable channel in which the tidal current "is rapid, and which contains from 12 to 20 "feet of water. The average depth of the "Lake, however, is not more than one and "a half feet, the shallow level margins are "scarcely ever completely drained of the "tide, and the water there may be considered "to be almost in a state of perfect stagna-"tion. The parts adjacent to the navigable "channel are better drained, and at low "water in the hot season are often to be "seen dry above the surface."

"The water thus dispersed is entirely tidal, "being derived directly from the sea by a "deep and winding creek, which runs from "the most southerly point of the Lake and "connects itself with another Soonderbun "Canal."

The unhealthiness of Entally and the Balliaghatta Canal.

"The navigation along these channels and "through the Lake is con-"tinued on to Calcutta by "a Canal which was exca-"vated in 1810 from the "margin of the Lake at Balliaghatta, "and terminates in a basin or cul-de-sac at "the suburb of Entally. This place, which "was formerly of importance as being the "principal Port for the eastern inland navi-"gation, has always been considered unheal-"thy and could scarcely indeed be otherwise "situated, as it is upon the marshy edge of "the Lake, and surrounded by dense low "jungle: the native dwellings there are "subject to constant low fevers, spleen, "dropsy, and mesenteric disease; to new "comers a residence of even a few days is "almost sure to be fatal."

"In 1803 or 1804 Marquis Wellesley directed "a vigilant watch to be kept at Balliaghatta "for some French deserters, who are supposed "to have fled by water in that direction. "A Police Special Guard of twelve men was "sent out and stationed there. After four "days it was reported to the Magistrate "that all but three of them were dangerously "ill, two were brought to Calcutta in the "height of delirium with yellow bilious "fever. The guard was relieved, and the "following week of the new Guard, all were "attacked by the fever. In less than two "weeks out of the twenty-four men six died."

"Near Balliaghatta an enterprising individual "has established a Salt "manufacture by solar eva- "poration, and from his "observation in one dry season he estimates "the daily evaporation from the Salt Water "of average condensation and specific gra- "vity 1072 to be three-tenths of an inch, "which exceeds the estimates of fresh "water evaporation made in the immediate "neighbourhood of Calcutta."

Salt manufacture near Balliaghatta.

9. Regarding the levels of the Lakes in 1830, the Commission have had some difficulty in selecting from amongst those of the different Officers who have recorded their observations. Major Schalch, Captain Thomson, and Captain Fitzgerald, as well as Captain Prinsep, have left statements which do not in some respect agree as to the levels of the Lakes. The Commission have adopted the levels of Captain Prinsep, Bengal Engineers, upon which Lord William Bentinck's Minute was based, in as much as he submitted a map of the Salt Lakes "prepared," he observes "upon a very "accurate and minute survey carried on by "an European under my own immediate "superintendence, and which may be relied "on for accuracy. The soundings were also "made by the same person and have been "generally verified by myself." Upon this map Captain Prinsep has drawn a guage representing the surface levels of the Lake tides and bed in relation to certain fixed points still existing, such as the bench mark at Chandpaul Ghaut and the sill of the old Dock at Kidderpore which is the datum or zero of the levels of the Calcutta Drainage Works and of the present project; and to the accuracy of this guage or scale of levels Colonel Sir Thomas Anbury, C. B., then Chief Engineer, bears favorable testimony.

Levels of the Lakes. Captain Prinsep's levels adopted by Commission for sake of comparison.

10. In the following Table Captain Prinsep's levels of 1830 reduced to sill of old Dock at Kidderpore, and Mr. Clark's of 1865 are given in juxtaposition:—

Comparative table of levels of the Salt Water Lakes in 1830 and in 1865.

Levels at Dhappa.	Captain Prinsep's in 1830.	Mr. Clark's in 1865. *
	Over Datum.	Over Datum.
Average bed of Lakes	6·3	8·0
Dry Season.		
High water, ordinary	7·9	11·2
Lower water „	.....	6·6
Lowest water, recorded	5·0	1·11*a*
Rains.		
High water, ordinary	9·9	11·9
Low water „	.....	7·9
Highest water, recorded	.....	13·0½
Lowest „ „	8·11*b*	5·7*d*

a.—On 21st April 1858. *b*.—See reply No. 7, page 8, Appendix G. of the Fever Hospital Committee's Report. *d*.—In July 1858.

11. The Commission have no hesitation in accepting Mr. Clark's levels as trustworthy; they have stood every test to which the Commission have been able to subject them.

12. From comparison of the figures in the Table, it will be observed that the average bed of the Lake has risen 1 foot 9 inches in the last thirty-five years: even more marked is the elevation of the tides both at high and low water and still more the increased range of the tides.

The bed and tides of the Salt Water Lakes have been elevated in the last thirty-five years.

13. Captain Prinsep does not give the level of ordinary low water in dry season, but he expressly mentions in his papers the extreme range of tide in the dry season to be only 2½ feet, and in the rains 10 inches.

Extreme range of tide in 1830 was 2½ feet in dry season and 10 inches in the rains.

14. In the present day the average range in ordinary spring tides of the dry season is 4 feet 8 inches, and in the rains it is 4 feet.

Present average range of spring tides 4 feet 8 inches in dry season, and 4 feet in rains.

15. The fact of an elevation in the bed and surface levels of the Salt Lakes is noted by the Calcutta Drainage Committee in 1857, and they concurred with Mr. Clark in attributing it to the influence of the Circular Canal, added, in their opinion, to the gradual restriction of the area of the Lake from 37 to 18 square miles.

Elevation of bed and surface levels of Lakes noticed by Drainage Committee in 1857 and attributed to the influence of the Circular Canal.

16. This Circular Canal was constructed at the instance of the late Major Schalch, and forms the second means of water communication between the Salt Lakes and the Hooghly. It is in fact an extension of the Balliaghatta Canal (excavated in 1810) to the Hooghly at Chitpore, and is provided with Lock Gates at its head, which were opened for the first time in June 1833. Since that period the admission of the Hooghly through the Canal Lock has been a matter of daily occurrence, except during short periods of the year when the great comparative height of the river would injure the banks of the Canal, on which occasions the gates are kept closed.

Circular Canal completed and Lock Gates opened first time in 1833.

17. This second communication between the river and Lakes has undoubtedly hastened the process of silting up the bed of the latter, to which the Hooghly has almost daily access through the numerous khalls intersecting it and communicating with the central channel.

The silting up of the Salt Lakes bed has been expedited by the admission of the Hooghly through the Circular Canal.

18. Some idea of the silting capability of this stream from the Hooghly may be formed from the fact of its having raised the bed of the Canal some 7 feet since it was deepened in 1860; at the present moment the Canal bed is at a higher level than it was before being re-excavated.

19. Another feature equally deserving of notice is the greatly increased size of the central channel through the Lakes. Captain Prinsep states that the sectional area at Bamunghatta was 1,920 square feet with a rise of tide in the dry season of 3 feet.

Increased size and range of tide in the Central Channel at Bamunghatta.

20. The present sectional area there is 6,175 square feet with a rise of tide in dry season from 7 to 8 feet.

21. Similarly, but not to so great an extent, the channel above Bamunghatta as far as Rajah's Khall has increased in size as well as range of tide.

22. This increase of channel may at first sight appear inconsistent with the ascertained silting up of the Lake bed, but in reality it is not so, for the average

Increased size of channel attributable to increased reflux of tide at the ebb.

level of the tide having risen proportionately higher than that of bed of the Lake with a greater range in its daily levels, a greater spill or reflux from the Lake into the channel now occurs than formerly.

23. The bed has risen 1 foot 9 inches, whilst the surface of ordinary tides in dry season has risen 3 feet 5 inches, or nearly double.

24. From the report* of the Executive Engineer of the Canals it appears that in the dry season the spring tides spill over the Lakes for a period of five days twice in the month, and occasionally to a depth of as much as 3 feet: he takes an average of 18 inches and calculates that a single spring tide must contain a spill of some 451 millions of cubic feet from the northern Lake alone, nearly all of which must pass Bamunghatta. This is a far greater quantity from 10¾ square miles than Captain Prinsep estimated from 18½ square miles.

Spring tides spill twice a month over Lake for a period of five days at a time, average depth of spill 18 inches.

25. The spill as given by the Executive Engineer may be somewhat over stated from the precise area not being known; but undoubtedly to its increased action in scouring, combined with the current derived from the Hooghly during a considerable period of ebb tide, the enlarged dimensions of the central channels at Bamunghatta are due.

26. This subject the Commission will have occasion to notice again in Section III.

27. To the elevation in the bed of the Salt Water Lakes and in a greater degree to the purifying action of an increased range of tide is due the improved sanitary state of the District between Calcutta and the Lakes compared with its condition as recorded by Dr. Duncan Stewart in 1836, but there is still abundant room for improvement as the Members of this Commission can testify from personal observation, and a visit to the Lake borders at Dhappa and east Entally will convince the most sceptical that a great deal remains to be done before this pestiferous and low lying ground can be converted into a healthy site for habitation. Of all the benefits expected from the drainage and reclamation of the Salt Lakes none will be so striking and so expeditiously developed as the prosperity of the District south of Balliaghatta and east of the Convent at Entally, which, from its position in reference to the rapidly expanding Railway and Canal traffic of the country converging to the east of Calcutta, will probably be at no very distant period the centre of a wealthy and prosperous community.

Improvement in sanitary state of Entally and its neighbourhood, and the results which will probably follow the reclamation of the Lakes.

Second Section.

The present project viewed in relation to the Calcutta Drainage Scheme.

1. The Salt Water Lake and Tardah Jungle are shewn on the accompanying Map, Appendix No. XII.

2. The following description is taken from a Note drawn up by Mr. Clark, Engineer to the Calcutta Justices.

3. The total area may be taken at 44½ square miles.

4. The distance of the nearest margin of the Lake from Circular Road, Calcutta, is about 2 miles.

5. At the above point, near Tengrah Haut, the entire drainage of Calcutta during the dry season will be discharged.

6. To this point also all the night soil and sweepings, stable litter and entire filth of Calcutta will be conveyed by the Municipal Railway as soon as completed.

7. The form of the area is an irregular square, and its average dimensions are about 7½ miles east and west by 6 miles from north to south.

8. It is intersected near the middle of its width by the central channel of the Lake, and bounded on its south side by Tolly's Nullah, both navigable streams.

9. The Tardah Jungle occupies the eastern portion, which is again divided by the Katta Khall, also a navigable stream.

10. The area may be thus estimated:—

	Square Miles.
South Lake, or that part south of the central channel	14·25
North Lake	10·8
Tardah Jungle	19·5
Total area ...	44·55

11. There are also numerous narrow inlets, some of them deep, by which the water enters and floods the land.

12. The central channel is from 13 to 17 feet deep, low water, with a rise of tide of about 5 feet. Tolly's Nullah, on the southern margin of the area, where the low water mark is 4 feet above datum (Kidderpore Dock Sill) has a rise of tide about 12 feet.

13. The central channel and Tolly's Nullah unite at a point called Samookpotta, distant about 16 miles from the Hooghly, measured on either stream.

14. Through Tolly's Nullah there is at all times a free communication between the water of the Hooghly and the Biddiadhurry River, while the central channel communicates with the river by the Chitpore Locks.

15. Embankments have been made along a part of Tolly's Nullah and portions of land reclaimed, while the central channel remains wholly unembanked, and but very small portions of the land have been reclaimed.

16. The surface of the country falls uniformly from the banks of the Hooghly, or 23 feet above datum, to the Lake, where the mud surface or bottom is 9 feet above datum. This fall of 14 feet occurs in a distance of 4 miles.

17. The bottom of the Lake, so far as at present known, varies but slightly, probably from 8 feet above datum* in the deep places to 9 feet at the margin, and the area is covered with water during the dry season to a depth varying from a few inches to 2 feet, while in the rains its depth is about 1 foot greater.

18. The large portion at low water is uncovered, and on parts of it coarse grass grows.

19. Several smaller streams intersect the area of the Lake, but they are only navigable for very small boats at high water.

20. Such is Mr. Clark's description. The project of the Company is to reclaim and bring this area under cultivation by first embanking and draining it, and then manuring and irrigating it with the sewage of Calcutta, which, according to the plan which the Justices contemplated before the present project was started, would have been discharged at Tengrah; a portion through the sewer ultimately to find its way into the central channel, and the more solid part, such as the stable refuse, by other means of transport, to be finally disposed of over a square mile of land which is in the Lake. The whole of this sewage the Justices have consented to make over to the Company at Tengrah.

21. The outlet of the Calcutta drainage will be a high level sewer extending from Palmer's Bridge in Entally to Tengrah on the margin of the Salt Water Lake. It will be 8,000 feet long, 6 feet internal height, with an inclination of 1 in 1,300. The bottom of this sewer at its discharging point in Tengrah will be 8·46 over datum, or a few inches above the present average level of bed of the Lakes, which is stated to be 8 feet over datum. The top of sewer internally will therefore be 14·46 over same, or 17 inches over the highest water-mark as yet recorded at Dhappa, which is 13·05. The intended quantity of sewage matter to be pumped through this sewer on the completion of the water-supply and drainage works of Calcutta will be 24 millions of gallons in the twenty-four hours; but the maximum quantity which *can* be pumped in twenty-four hours with safety to the sewer is in round figures 34 millions of gallons, and, as in periods of storm waters the Municipality might exercise the right of discharging this quantity, the Commission adopt it as the extreme quantity to be dealt with: when the sewer is discharging this quantity its surface level will stand at 12·71 feet over datum. The sewer will discharge in the Rajah's Khall, which will carry the sewage a further distance of 8,000 feet into the central channel of the Lake. The maximum height of the tide which has been observed at Dhappa on the central channel is more than 13 feet above datum, so that the tide has on one occasion at least risen above the level which would be obtained by the water in the sewer when discharging its maximum quantity. A rise of tide above 12 feet over datum is not infrequent. In 1858 when observations were taken, this took place on thirty-three days in the months of June, July, August, and September. Hence there is reason to believe that the continuity of the outfall from the sewer will be affected should the range of tide continue to increase from natural causes as it has been doing hitherto. This danger will be obviated by the conditions under which the Company will undertake its operations.

Conditions imposed by Calcutta Municipality relative to surface level of water to be maintained by Salt Water Lakes Reclamation Company.

Among those which the Calcutta Municipality have imposed upon the Promoters of the Salt Water Lakes Reclamation Company, one of the most prominent is that such arrangements be made as shall prevent the surface level of the water into which the Tengrah high level sewer will discharge from exceeding a maximum height of 12 feet above Kidderpore Dock Sill.

One of the conditions doubtful.

22. This is a clear and, as regards the Calcutta Drainage Works, an indispensable condition; but it is accompanied by another, the object and necessity of which is not so clear or self-evident, *viz.*,—"that sufficient weirs or "overflows be provided between the natural streams "and the reclaimed area of land to limit "the maximum height of the water surface in "these streams to a level of 12 feet above Kid-"derpore Dock Sill." Considerable doubt has been experienced regarding the term "natural "streams" in this condition, and unfortunately Mr. Clark's absence has prevented the doubt being entirely dispelled. Mr. Anley, who officiates for Mr. Clark as Engineer to the Municipality, is of opinion that this term was intended to include the central channel of the Lake. If such be the interpretation of the condition, the Commission are of opinion it is not only unnecessary but very objectionable.

23. For, as already shewn, from causes which neither the Municipality nor the Salt Water Lakes Reclamation Company can control, the surface of the central channel is frequently over the assigned maximum limit of 12 feet above Kidderpore Dock Sill, and to furnish overflows between it and the reclaimed land would simply be to injure the latter without proving in the least degree of service to the Calcutta Drainage, for it cannot be supposed that any overflow which in reason could be provided would have the effect of lowering the surface of so capacious a channel fed from the Hooghly and the sea. It is possible, however, the condition may not have been intended by Mr. Clark to embrace the central channel of Tolly's Nullah, but only those streams which act as flood channels for the fresh water drainage of the surrounding lands, and in this view of the case the objection entertained by the Commission would no longer apply with the same force.

Land floods can only come from west and north sides of the reclamation area.

24. There are but two quarters from which land floods can come, from Ballygunge and its neighbourhood on the western side, and from the direction of Dum-Dum on the northern extremity of the Lakes. These should doubtless be provided for,

Catchwater drains to intercept land floods from west and north sides recommended.

but in carrying out extensive drainage operations in low lying lands liks those of the Salt Water Lakes, it has been recognized almost as a maxim that the floods of the higher and adjacent lands should be intercepted and discharged into the main watercourses of the country by channels separate and independent of those draining the low lands.

25. This principle of catchwater drains was acted upon by Rennie in draining the Lincolnshire Fens in the last century, and it has been successfully followed in other drainage operations since that period. The Commission are of

One to discharge the west side or Ballygunge drainage into Tolly's Nullah.

opinion that a catchwater drain could be made to intercept and discharge the drainage from Ballygunge into Tolly's Nullah near the South-Eastern Railway's Bridge at Gurreah, and that this catchwater drain should form the western boundary of the southern portion of the reclaimed area with which it might communicate through sluices at the option of the Company for purposes of irrigation. There is nothing to prevent this in the levels, as low water in Tolly's Nullah near the bridge is only 2′ 9″ over datum in the dry season; the bed of existing water-course from Ballygunge where it crosses under the South-Eastern Railway beng *9′ 8″ over the same.

26. In the rains the low water surface of Tolly's Nullah at the Railway Bridge will be higher: the exact level the Commission do not know, but taking it to be the same as that of the central channel at Dhappa, or 7′ 9,″ it would still be feasiblo to discharge this Ballygunge drainage into the nullah through a self-acting sluice provided with a small reservoir near the outlet into which the land drainage during high water might be received.

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* On South-Eastern Railway Section ... ... 17·90
Deduct the difference in datum levels... ... 8·25
9·65

27. It would be equally feasible to form a catchwater drain along the north-eastern margin of the Lakes to intercept and discharge the land drainage from Dum-Dum by a distinct channel into one of the khalls outside the reclaimed area falling into one of the Soonderbun creeks east of Bamunghatta.

Another to discharge the north side or Dum-Dum drainage into one of the Soonderbund Creeks east of Bamunghatta.

28. By this means the reclaimed area exclusive of the Tardah Jungle would be embanked as it were by a ring of fence, and in the rains it would only have to provide for the discharge of the rainfall on its own surface and for the Calcutta sewage. The Commission are of opinion that a condition binding the Company to provide such outlets as shall prevent the water into which the high level sewer discharges, from rising to a greater height than 12 feet above datum, will amply protect the Calcutta Drainage Scheme system from any evil effects which the Company's operations can cause, and that such a condition will be a direct gain to the Justices, in that it will provide a means of counteracting the liability of their system to interruption from a rise in the level of the tides from natural causes. They are also of opinion that the catch-water drains which have been proposed will be sufficient provision for the drainage of the suburbs about Ballygunge and for that of the country to the north about Dum-Dum.

Third Section.

The present project viewed in relation to the navigation channels running through the Salt Water Lakes.

1. The traffic on the Calcutta Canals which passes through the central channel of the Salt Water Lake and that which passes through Tolly's Nullah (as shewn in the marginal Table) are so important and so intimately connected with the well-being of Calcutta and of the commercial prosperity of the country that the possibility of the proposed project affecting these lines of navigation demands careful enquiry. The danger apprehended is the silting up of the channels.

Traffic on Canals and Tolly's Nullah.

Years.	Boats passing through the Circular Canal.	Boats passing through Tolly's Nullah.	Total.
1855-56	87,780	84,215	1,71,995
1856-57	92,475	73,776	1,66,251
1857-58	97,095	77,139	1,74,234
1858-59	1,06,200	72,063	1,78,263
1859-60	91,133	96,579	1,87,712
1860-61	1,35,410	8,365	1,43,775
1861-62	1,41,963	93,794	2,35,747
1862-63	1,45,727	68,737	2,14,464
1863-64	1,45,778	87,274	2,33,052
1864-65	1,54,909	81,153	2,36,062

Previous to 1860 boats under 25 maunds burden were not included as they paid no toll.

In 1863-64 of 1,45,778 which entered the Circular Canal 1,11,396 passed through the central channel.

No likelihood of navigation channel below Bamunghatta being injured by embankment of Lakes.

2. It has been already stated that the dimensions of the central channel have greatly increased of late years; the section* lately taken by Mr. Archer at Bamunghatta shewing an area of 6,175 square feet of more than thrice the capacity it had in 1830. Below this place there is no probability of the navigation channels being injuriously affected by the embankment of the Lakes, for the tidal current has a free unchecked course from the Biddiadhurry through a very deep and capacious channel and passes eastward at Bamunghatta into the Katta Khall, as well as northward through the central channel towards Dhappa. In the eastern channel it meets another tidal current from the Soonderbuns, and the flux and reflux thus constantly going on will prevent the channel between Bamunghatta and Samookpotta from deterioration. Above Bamunghatta the sectional area at high water diminishes from 6,175 square feet to 1,809 in a distance of 4 miles: the latter is its capacity a little below the mouth of the Rajah's Khall where the Company's lock and outlet from the Calcutta drainage are intended to be built, and here the danger must be looked for. The quantity of water which spills over the northern Lake, and eventually returns into the channel and flows through it when the tide ebbs, has already been stated at 451 millions of cubic feet for a single spring tide: that from the southern side is given by the Executive Engineer as 595 millions from 14¼ square miles. Fully half of this quantity, however, is discharged into the channel south of Bamunghatta, and therefore should not be included in this calculation.

* The section taken this year in June at 11th mile, a short distance below Bamunghatta, gives a depth of 36 feet at high water.

Taking, therefore, for the northern Lake ... 451 millions,

And half of southern Lake, say... 299 ,,

750 millions,

The discharge of a single spring tide from the Lakes' surface above Bamunghatta is calculated at 750 millions of cubic feet.

we have 750 millions cubic feet as the quantity of spill which is now returned through the central channel past Bamunghatta during a single ebb tide.

3. Assuming the very longest ebb recorded of eight hours, this body of water would be discharged through the present channel at Bamunghatta at an average velocity of three miles* per hour. This, however, is believed to be far less than the actual velocity, which is always great.†

* 750 millions=26,041 cubic feet per second in an ebb of eight hours, and 26,042—6,175 area of channel, gives a velocity per second of 4·21, or nearly three miles per hour.

† So strong is the current even near high water that Mr. Archer, the Assistant Engineer, had to use a 9lb lead to take soundings for his section.

4. The proposed embankments will decrease the volume of water to be discharged by ebb tide to the extent of this spill, and will so lessen the scour which the reflux occasions in the central channel; but this will not be unattended with benefit, for at the present time the current is acting injuriously on the banks at Bamunghatta, and a considerable expenditure has to be incurred in protecting the Toll-house from being swept away.‡ The Commission consider that the diminution of the scour to that extent is unavoidable, but they consider that the evil is more than compensated for by the public benefits to be derived from the proposed operations.

The exclusion of this tidal volume from Lakes' surface will lessen the scour.

‡ The facing of the bank with broken brick, and protecting it with piling, which are in progress, are estimated to cost Rupees 5,832. The Toll-house, a good upper-roomed house, is only 30 feet from the bank, which has been undergoing erosion, but this is now checked by the protective works.

5. The flow and ebb of the tide through this channel when embanked throughout from Bamunghatta to Dhappa will probably be attended with a greater range from the restriction of the currents,

The range of tide will probably be increased after the central channel shall be embanked.

as in the case of Tolly's Nullah, where the range is 12 feet, some seven miles above its junction with the Biddiadhurry.

Present range of tide much greater than in 1830.

6. The average range of tide in dry season at Dhappa is now 4·8, and, as already mentioned, this is a great advance upon the range of 1830. It may be anticipated that this increase in range will be progressive, and that the artificial measures now to be adopted will produce results as marked as those gradually accomplished by nature within the last thirty-five years.

Surface levels of the Mutlah River at Port Canning.

7. So long, however, as the surface of the Multah maintains its relative level to the Hooghly, there is no cause for alarm in those alterations of level in the intervening country and water channels.

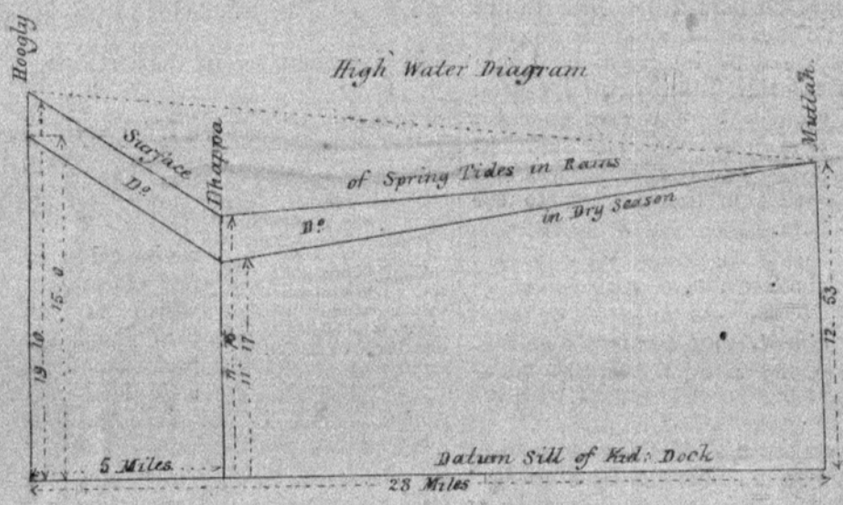
The high water level in spring tides at Port Canning the same during rains as in dry season.

8. The high water level of spring tides in the Mutlah at Port Canning is the same in the rains as in the dry season, and it stands at 12·53 over Kidderpore Dock Sill.

Range of tides at Port Canning.

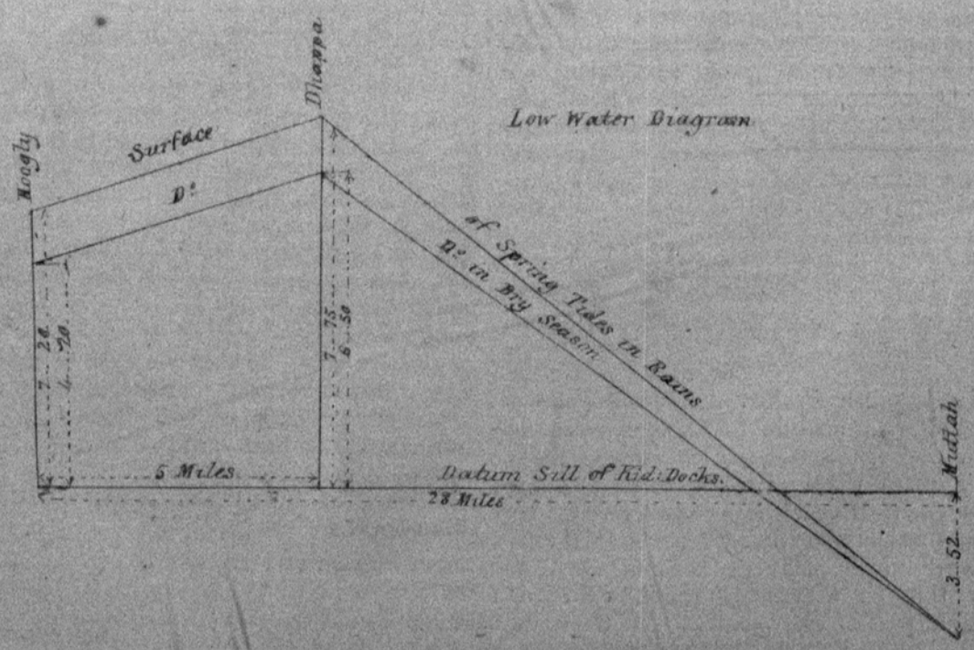
9. The range of spring tides is 16·05 and of neaps 11·12 throughout the year, undisturbed except at the equinoxes, when a range of 18½ feet has been observed. Compared with the surface of the Hooghly, its high water of spring tides is lower in the dry season by 2·47 and in the rains by 6·57; but the most remarkable difference in level is at times of low water of spring tides, when in the dry season the Mutlah is 7·72 and in the rains 10·72 below the Hooghly.

10. It will be observed, in comparing those with the present average high and low water levels of the Lake channels at Dhappa, that the latter occupies an abnormal position with regard to the Hooghly and Mutlah as shewn in Diagram:—



11. Were the slope between the Hooghly and Mutlah uniform as shewn in dotted lines, the water surface in rains at Dhappa would be 17·93 over datum instead of 11·75, and in the dry season it would read 14·56 in lieu of 11·17.

12. A comparison at low water inverts the relation of these levels, then, as will be seen from following Diagram, Dhappa is higher than either the Hooghly or Mutlah:—



Under a normal state of the tides at low water Dhappa should be 5·29 in the rains and 2·83

13. Thus, were a uniform slope established, Dhappa would have a range of tide as under—

	Rains.		Dry Season.
High Water	... 17·93	...	14·56
Low Water	... 5·29	...	2·83
	12·64	...	11·73
instead of	4·00	...	4·66

14. Looking at this state of things the Commission is of opinion that on the construction of the second lock at Chitpore which is known to be imperatively required for the convenience of Canal traffic, and on the completion of the Salt Lakes embankments a further rise in high water level at Dhappa will occur, but not to the normal height of 17·93 in the rains.

High water level at Dhappa will probably rise higher over datum.

15 It is not improbable that the Dhappa high water will frequently rise to 14 and 15 feet over datum.

Dhappa high water line will probably rise to 14 and 15 feet over datum.

16. The low water line will not, however, fall below that of the Hooghly, for, like all the tidal channels of the country which are fed by tides from both ends, the low water line is invariably at a higher level at the point of junction than at the extremities of the channel.

17. The introduction of a greater volume of water from the Hooghly will undoubtedly produce a greater deposit of silt in much the same place as at present, and will probably extend it a little further downwards towards Rajah's Khall: this will be caused not by the embankment but by the opening of the second communication with the Hooghly through the lock.

A greater deposit of silt may be expected to result from the introduction of more water from the Hooghly.

18. The increased volume of Hooghly water in the channel would much facilitate any operations which the Company may hereafter undertake for warping up the low lands.

19. Neither the Executive Engineer of the Canals nor the Collector of Tolls entertain any apprehensions regarding the navigation from the embankment of the Salt Lakes, and the only stipulation they make is that, for the convenience of the Canal Traffic, a strip of 100 feet wide on each side between the edge of the channel and the proposed embankments be excluded from the reclaimed area. This is the only condition which the Commission think it necessary to impose in the interests of the Canals.

The Executive Engineer of the Canals and Collector of Tolls entertain no apprehensions for the Canal navigation from the Salt Water Lakes' Embankments.

They propose a marginal strip of land along channels to be retained for Canal Traffic.

20. There will be one undoubted benefit to the Canals accruing from this reclamation work, *viz.*, the absorption of the sewage matter and solid filth of Calcutta which were intended to be discharged into these navigation channels to their incalculable detriment.

Fourth Section.

The area to be reclaimed and probable cost of purchasing it.

1. The Company propose to reclaim an area of about 44 square miles as shewn in the annexed Map drawn up by Mr. Heysham marked XII. It consists of the northern and southern Lakes and of the tract known as the Tardah Jungle, the whole being bounded on the south by the Tolly's Nullah.

The area to be reclaimed.

2. The Commission have visited the lands. They may be divided into five general classes: —

Classification of the land.

1*st.*—Lands covered with salt water and used for fisheries.

2*nd.*—Lands inhabited and first class cultivated land.

3*rd.*—Second class cultivated land.

4*th.*—Marshy salt land clear of jungle, but unreclaimed and unproductive.

5*th.*—Lands covered with jungle, unreclaimed and unproductive.

Mr. Heysham in his letter No. 189, dated 24th June 1865, to the address of the Commissioner of the Nuddea Division, gives the following Table of Villages, of which the lands fall within the boundary :—

No. of Plan.	Names of Villages.	Area in Beegahs.
236	Dhappamanpore Salt Water Lake ...	24,191 0 0
227	Bhugwanpore ...	3,893 0 0
217	Kurreempore ...	581 0 0
230	Khoorkee ...	1,546 0 0
227½	Khoorkee Chuck ...	97 0 0
229	Dearah ...	1,954 0 0
209	Khoodhauttee ...	1,939 0 0
215	Hydyah ...	4,643 0 0
222	Beeanteeah ...	8,004 0 0
226	Tardah ...	19,185 0 0
172½	Hauthgatchee ...	112 0 0
164	Bynetullah ...	814 0 0
234	Saupgatcha ...	260 0 0
165	Chowbagah ...	702 0 0
238	Auntoband ...	127 0 0
168	Goalpottah ...	326 0 0
202	Komarpookkorea ...	729 0 0
210	Kheardoho ...	1,848 0 0
136	Teehoorah ...	2,931 0 0
173	Noabad ...	2,223 0 0
6	Kanteepottah ...	892 0 0
220	Ranabooreah ...	1,194 0 0
184	Autghurreeah ...	565 0 0
3	Noabad ...	1,061 0 0
185	Juggateepottah ...	154 0 0
22	Mamoodpore ...	60 0 0
25	Mokoondoopore ...	390 0 0
213	Bhogwanpore ...	293 0 0
4	Kalekapore ...	862 0 0
238	Borookullah ...	683 0 0
8½	Gunnigatchee ...	426 0 0
11	Panchpottah ...	668 0 0
235	Dhelloo ...	599 0 0
247	Mirzapore ...	154 0 0
	Punchannogram land	646 0 0
	Total ...	84,782 0 0

Aspect of the country.

3. Lands of the first class lie principally about Dhappa in the western portion of the north Lake and north-western portion of the Salt Lake. From Dhappa the salt water is to be seen lying in sheets or small lakes interspersed among the green. As the traveller goes down the central channel south-east these disappear, and the green salt marsh extends on both sides; further south-east the marsh is covered by jungle, and then on entering the Biddiadhurry at Bamunghatta and proceeding south the forest of the tract known under the general name of the Tardah Jungle is found. All these are salt lands. About Samookpotta (the junction of the central channel and Tolly's Canal) attempts at clearing the jungle have been made, but some of the lands which have been cleared have been allowed to relapse into jungle. Here the Government embankment runs along the southern bank of Tolly's Canal, which is the boundary of the proposed area to be reclaimed. The land to the south is under cultivation; and population is being attracted. On the northern bank of Tolly's Canal, however, the lands are unreclaimed, and there is jungle as far west as Nowabad. At this point the fresh water from the Hooghly meets the salt water from the Mutlah and inundates the lands: here the north of the Canal is partially embanked and rice cultivation extends irregularly one or two miles northwards. These are the first class cultivated lands.

4. The Company ask that the 44 square miles of land above described be taken up under the power vested in the Government by Section 26, Act XXII. of 1863 and made over to them for reclamation.

5. As to the propriety of taking up with this object the lands which are covered with salt water and the marshes there can be no question, and as it is essential to the operation of the Company that they shall have the full control of the sweet water in Tolly's Canal and of the approaches to it, it will perhaps be impracticable to carry out the scheme without taking up the first class sweet rice lands which lie to the north of the nullah. These lands will, however, be expensive; and if the Company make arrangements by which they can avoid the necessity of buying them outright it will probably be for their advantage so to do. The surveys and demarcation of boundaries which, under Section 22 of the Act, will be undertaken after the definitive registry of the work will enable the Government and the Company to decide on this point.

The Salt land and marsh to be taken up for the Company.

Southern lands of Lakes expensive

6. As to the tract known as the Tardah Jungle, about 19 square miles, the possession of it does not seem to be essential to the Company's scheme of reclaiming and draining the Salt Water Lake, but it is obviously desirable on sanitary grounds that this belt of jungle lying so near Calcutta should be cleared away; the Commission are of opinion that the clearance of it is exactly such a work of public utility as is completed by Act XXII., and that the Government might with propriety take it up for this Company or for any other which would give a guarantee that they can clear, embank, and drain it within a reasonable period. In its present state of vegetation, however, it is probably less injurious to health than the unwooded salt marsh, as the tree vegetation must absorb and shut in much of the malaria. As a proof of this it is noted that, while the establishment of the Dhappa Toll Station, which is surrounded by marsh, is extremely liable to attacks of fever, the men located at the Bamunghatta Station among the forest are reported by the Collector of Tolls to be much less unhealthy. In giving over the Tardah Jungle it will be necessary to impose a condition that no more land be cleared of jungle annually than can at once be placed under cultivation.

Clearance of Tardah Jungle, a work of public benefit.

Forest less noxious than swamp.

No more land to be cleared of jungle than can at once be cultivated.

7. To make an accurate estimate of the cost of buying the land which the Company require is impossible, until the surveys contemplated by Section 22 shall have been made and the exact quantity of each kind of land ascertained; but the Commission have taken the estimate of Mr. W. Heysham, Deputy Collector of Calcutta, on this point, whose personal knowledge of the Lake and of the value of land in the neighbourhood of Calcutta entitles his opinion to great weight. Mr. Heysham writes:—

Estimated cost of purchasing land.

"The land is Zemindaree. The most lucrative "portions are farmed out "for fisheries, the lessees of "which claim to hold them under perpetual "leases. The owners deny that claim and "declare all the lands under farm to be let "out on limited leases, and their occupants "to be tenants at will. It may safely be "classified under five different heads, *viz.*, "1*st*, Salt land used for fisheries; 2*nd*, Land "inhabited and under first class cultivation; "3*rd*, Second class cultivated land; 4*th*, "Salt land clear of jungle but unreclaimed "and unproductive; 5*th*, Unreclaimed and "unproductive jungle land."

Mr. Heysham's estimate.

"It will be impossible without a detailed survey to shew the correct position and extent "of the different descriptions of land which "this extensive area contains. But I have "endeavored to give a general definition of "them in my plan."

"I estimate the cost of acquiring the entire "land at Rupees "8,96,000 as per "margin."

Description of Land.	Area.	Rate per Beegah.	Value.
1. Salt land used for fisheries ...	9,000	30	2,70,000
2. Land inhabited and under first class cultivation	5,900	20	1,18,000
3. Second class cultivated land	9,000	12	1,08,000
4. Salt land clear of jungles but unreclaimed and unproductive ..	20,000	10	2,00,000
5. Unreclaimed and unproductive jungle land	40,000	5	2,00,000
Total ...	83,900		8,96,000

"I have fixed the "value of the "fishery lands, "which are the "most lucrative, "at Rupees 30 "per beegah on "the awards of "the arbitrators "appointed in "three distinct "cases to value "them under "Act VI. of "1857, and I "arrived at the "value of the cultivated salt and jungle "lands after enquiry from local rates."

"Lest, however, any doubts should be entertained on this very important point, I beg "to subjoin two Statements A. and B. "A. gives the area of Government Khass "Mehals, all contiguous to Calcutta, which "were sold in 1861-62 under the orders of "Government, the amount of their jumma, "the proceeds they realized at the sale, and "their value per beegah. B. is a similar "Statement of the Soonderbund lots, which "were sold last year under the provision of "Act XI. of 1859. Both Statements will, "I trust, prove that I have been liberal in "my estimates, and that the lands may be "acquired at even a lower cost without any "injustice or detriment to the owners."

A.

Number of Mehal.	Number of Pergunnah.	Area of Land.	Amount of Jumma.	Amount of Sale Proceeds.	Rate per Beegah.
			Rs. As. P.	Rs. As. P.	Rs. As. P.
312	Beelsingah	7,980 0 12	12,876 7 2	60,100 0 0	7 9 0
352	Balleah	4,891 4 10	5,352 3 2	49,200 0 0	10 12 0
384	Bunidhattee	10,042 1 5	7,289 4 8½	69,000 0 0	9 0 0
411	Mugoorah	2,071 15 0	2,551 3 6	10,750 0 0	5 8 0
414	Mooragatcha	1,584 17 11	775 15 6	17,100 0 0	10 11 0
443	Pachakoolee	4,852 19 6	5,861 11 1	34,000 0 0	7 0 0
373	Hateaghur	26,112 11 14	16,877 2 7	1,10,000 0 0	4 0 0

B.

Number of Mehal.	Name of Zemindar.	Area of Land.	Amount of Jumma.	Amount of Sale Proceeds.	Rate per Beegah.
			Rs. As. P.	Rs. As. P.	Rs. As P.
989	Goopeenath Roy, &c...	3,682 11 8	1,582 13 8	10,100 0 0	2 11 0
1501	Shammonee Dossee...	29,400 0 0	653 7 6	5,800 0 0	0 3 0
1653	Callybromo Roy ...	157 18 0	44 15 9	25 0 0	0 2 0
1811	Kazee Enamuz Huck	309 15 0	172 0 1	310 0 0	1 0 0

Prevailing rates.

8. No better data are available, and the Commission will adopt this estimate for the calculations which follow. They find by local enquiry that when lands are embanked and brought under cultivation, the ryots pay at first Rupees 1-4 per beegah, and that then the rate gradually increases up to Rupees 1-8 and 2 Rupees, and even in some places to 3 Rupees. It will be observed that Mr. Heysham's calculations for these cultivated lands assume a rent of rather more than Rupees 1-5 a beegah as the average for the first class of cultivation, which seems low; but Mr. Heysham's average rate is calculated on the gross area of the cultivated tracts inclusive of the interspersed barren patches, lands occupied by bunds, &c.; whereas the Rupees 1-4 or Rupees 2 which the ryots pay is on the actual area of the fields which they plant with paddy. If the cost of purchasing the cultivated lands have been somewhat under-estimated, the Commission believe that the difference will be made up from the estimate for the unreclaimed marsh in which 10 annas 8 pie is assumed as the annual profit. In adopting this estimate, however, the Commission desire to remind the Government that the price will probably be fixed by Arbitrators, who are entirely irresponsible, and that, in the taking up of the Railway lands, it was shewn that different bodies of arbitrators proceed on such very different data that it is quite impossible to form an approximate idea as to what will be awarded in any given case.

Lands belonging to Government.

9. In addition to the Zemindaree land from 700 to 1,400 beegahs of Government Punchannogram land will fall within the Company's boundaries, which the Government will doubtless give over free of cost.

Section V.

On the disposal and utilization of the sewage in the manner proposed by the Company considered both from an agricultural and sanitary point of view.

Quantity of Calcutta sewage.

1. The sewage matter daily created by the population of Calcutta, assumed at 5,00,000, is calculated to amount to 200 tons. When the Justices' schemes of drainage and water-supply are carried out, this matter, or so much of it as is not surreptitiously disposed of, will be delivered at Tengrah, diluted with a minimum quantity of 12 millions or a maximum of 36 millions of gallons of water.

Proposed mode of treatment.

2. Until the works are completed, the matter will be delivered at Tengrah undiluted, and, it is presumed, will there be thrown into the Company's reservoirs and artificially diluted with water from the central channel. When so diluted the fluid will be distributed over the area to be reclaimed through the Company's irrigation channels: whatever matter may remain of a consistency too solid to be so distributed will be carried and spread over the land by hand.

Deodorization. Results at Carlisle.

3. It is a part of the Company's scheme to deodorize the sewage before it is used, and they have provided Rupees 10,000 a year for this purpose. It is stated in the *Lancet* of October 13th 1860, that the average sewage of Carlisle is 6,66,116 gallons: that was deodorized "with complete success" by McDougall's carbolic acid solution, and then led over about 100 acres of land, the cost of the disinfecting material being five shillings and three pence per diem, or £95 per annum.

At Croydon.

It is also stated that the same mixture is used at Croydon "with perfect success;" and in an experiment by Dr. Letheby the carbolic acid was poured into the head of a system of sewers containing the excreta of about 21,000 inhabitants. The proportion was one gallon of carbolic acid to 32,000 gallons of sewage, and the result was so perfect that sewage taken near the river outlet was found to be entirely free from putrefaction.

Experiment by Dr. Letheby.

Experiments in Calcutta.

4. Experiments have been made with McDougall's powder in the Allipore Jail by the Medical Member of this Commission, which have established that, efficacious as the powder is when first applied, its effect is only transient. Further, it is found that, for the perfect deodorization, even temporarily of the *solid* excreta of eight men, 1 lb of McDougall's powder is required, so that for the whole produce of Calcutta no less than 62,500lbs. must be used daily. The price of the powder in Calcutta is Rupees 7 per cwt., so that the cost would be no less than Rupees 3,906 per diem, or Rupees 14,25,690 per annum. Calculations by the Chairman of the Calcutta Justices founded on experiments made in Calcutta require 30 tons daily for the deodorization of the whole Calcutta sewage entailing a daily outlay at Rupees 2,800. The Commission have no means of reconciling the result of these experiments with those which are reported at Carlisle. They can only surmise that when the night soil is largely diluted with water, as it is in the course of its passage through the sewers and in the Company's reservoir, a very much smaller quantity of deodorizing matter suffices.

Deodorization not indispensable.

5. It can scarcely be doubted that further enquiry into the means adopted in England will shew that they are practicable in this country; but even if it were to appear that this part of the scheme must be abandoned on account of its expense, and the sewage distributed without any attempt at deodorization, the Commission believe that night soil would be sufficiently deodorized for sanatory purposes by breaking up its mass and spreading it out over a large area of earth as the Company propose to do.

6. The prospect of 200 tons of night soil daily spread out within a distance of from 3 to 10 miles from Calcutta without deodorization may at first sight be appalling; but fortunately the experiment is not new, and the results can be predicted from actual experience.

7. The sewage of Edinburgh has been for many years disposed of in this manner at Lochend and Craigintinny, Grange, and Dalby, *i. e.*, to the north, east, south, and west of the town; so that Edinburgh has been almost surrounded by sewage manured land, and little air can arrive at the town without passing over this land. In a paper on the utilization of sewage which was read by Mr. Morton at a Meeting of the Society of Arts in February 1865, it is stated that "in Edinburgh 400 acres of land treated "filthily have been for a century and more "under the very noses of the people, who "have, moreover, been fed for generations on "the milk of the cows which have consumed "this sewaged grass. If any evils of the "kind alleged (putrid miasma, resultant "fever, and new parasitic enemies) are in "the least to be expected, they must long "ago have shewn themselves in the death "rate of so large a town, which however, "I believe, stands as low as that of any in "the country." In his Report for 1863 on the sanitary state of the Army, the Director-General writes that the Cavalry Barracks at Lochend are surrounded by sewaged lands, yet the Soldiers do not suffer from malarious diseases. In Edinburgh it does not appear that there has been any attempt at deodorization.

Not practised at Edinburgh.

No bad sanatory effects.

8. Sewage has also been similarly utilized in Birmingham, Croydon, Worthing, Carlisle, and many other English Towns, (with or without deodorization,) without producing any bad effect on the health of the inhabitants. It is stated in an article in the *Builder* of March 25th 1865, that at Croydon, before the sanitary arrangements for the utilization of sewage (which have been in force fourteen years) were made, the average annual number of deaths in 1,000 persons had been 22, whereas the average for the "last ten years was only 19, "while that of Brighton, which ought to "be the Sanitarium of London, was 22."

Sewage utilized in many English Towns.

9. Two precautionary conditions on this head must, however, be imposed on the Company and strictly enforced:—

Necessary precautions.

Mass of sewage to be broken.

1*st*.—That the mass of diluted sewage be not allowed to remain aggregated for any length of time in their reservoir: it must be diffused as promptly as possible.

Contact of salt water not to be allowed.

2*nd*.—That the lands must be most thoroughly drained of salt water, and the possibility of salt water having access to them perfectly guarded against before sewage is run over them.

10. Disagreeable as is the fœtor from night soil, it is an accepted fact that it is not *in se* unwholesome. The danger lies in the tendency of foul masses to foster the germs of the poisons of cholera and zymotic diseases which expand thence. It is therefore of the utmost importance to break up such masses before they have become the nest of these poisons.

Foul odour disagreeable, but not *in se* noxious.

11. As to the necessity of avoiding the contact between the sewage and salt water, the Commission are aware that the Drainage Committee of Calcutta, which sat in 1857, expressed an opinion diametrically opposite to that which the present Commission hold. The Drainage Committee believed that if the contents of Calcutta sewers were to be discharged into the Lake, the salt in the waters "would have the effect found at Venice and "elsewhere of disinfecting them and rendering them innocuous."

Mixture of salt water and sewage.

Opinion of Drainage Committee.

12. This opinion contrasts strikingly with the following extract from the *Lancet* of December 8th 1860:—"Of all disgusting compounds that the "skill of the chemist or the arts of the "manufacturer can create, there are few more "offensive or more dangerous than the mixture of sea water and sewage. The decomposition which takes place when these agents "come together are such as the Sanitarian "would most strenuously avoid."

Medical Opinions.

13. In refutation of the views of the Drainage Committee, a pamphlet on the Salt Water Lakes issued by Dr. Chevers in the present year contains the following passages:—

Dr. Norman Chevers' opinion.

"The idea that the presence of sea salt in "water adds to the antisceptic power of that "fluid, or can possibly have any effect "whatever in deodorizing the sewage of "Venice or Calcutta, is plainly a scientific "blunder; the fact being that water loses "its power of deodorizing sewage matter in "direct proportion to the quantity of its "saline ingredients."

"In the Report of our Committee on the "Drainage of Calcutta submitted in 1861, "Colonel Beadle, in refuting the idea that "the salt water of the Lagoon powerfully "deodorizes the sewage of Venice, observed "that from his own observation on the west "shore of Bengal he is certain that salt "water gets quickly putrescent when it "spreads on land over a clay bottom and has "but little movement. This also certainly "occurs at one spot in the Andaman Islands. "On visiting the Salt Water Lakes more "than once towards the end of the rains, "when the waters were at their fullest, I "found the water of Tengrah Creek nearly "black, turbid, and in the body quite destitute of transparency. Water of a more "evil and stygian appearance could scarcely "be met within any marsh."

"With regard to the effects of salt water upon "deodorizing animal and vegetable matters, "Colonel Beadle remarked that any person "who has landed at Marseilles must remember the dreadful stench of the fœtid "waters which have received the sewage of "that city. I well recollect the arrangements for voiding the sewage of Portsmouth and Southsea when they were in a "very primitive condition. In places like "the Camber where sewage fell into a vast "body of somewhat stagnant salt water, this "water became quite black in still and hot "weather, and gave off most offensive effluvia. "At a place near Felton's Gibbet, where most "of the sewage of Southsea ran into a salt "swamp, the exhalations were so deleterious "that soldiers exercising on the adjacent "common have been known to fall when

"wind laden with the stench of this slough "blew upon them.

"Most of the excreta and sewage filth of "Bombay was a few years ago deposited in "a backwater of the sea called Backbay, "which, although extremely shallow and "little more than dead water, can scarcely "be so stagnant a place as the Salt Lake is. "It was, however, emphatically described as "a 'source of nuisance and disease to all "who had the misfortune to reside within "the reach of the malaria arising from it.' "It was consequently held by competent "authority to be indispensably needful that "the night soil of Bombay should be dis-"posed of in some altogether different "manner." Dr. Chevers also shews that the Venetian death rate is extraordinarily high. With this testimony before them the Commission cannot but reject the doctrine held by the Drainage Committee of 1857.

Opinion of the Commission.

14. When once the sewage is diffused over the lands after they have been brought into cultivation, it is probable that the vigour of vegetation in a tropical climate will have the effect of absorbing it more rapidly than it is absorbed in England.

15. As to the Agricultural benefits to be derived from the use of the sewage in the manner proposed, the Commission cannot point to the result of experiments in this country. The medical member speaks from personal knowledge that sewage is copiously applied to rice fields in China, where it bears a price which sufficiently proves that its effect is valuable.

Agricultural use of sewage.

16. In England the subject has received much attention in late years. Two Parliamentary Committees have held enquiries on it. The quantity which can be most profitably applied to a given area has been much discussed. At Worthing, of which the population is 7,000, Mr. Robinson, Engineer to the Board of Health, distributes the whole sewage over 400 acres, giving 17 persons to the acre. Sir J. Paxton recommends 250 persons to the acre. Market Gardeners near London sometimes apply 70 tons of solid matter, which is equivalent to 700 tons of liquid sewage to the acre: this represents 140 inhabitants. At Cassiobury, the Earl of Essex at first distributed the sewage of 4,000 inhabitants over 200 acres of land, but found it more profitable to distribute the whole in summer over 8 acres of rye grass, and in winter over 30 or 40 acres of Park Land. At Croydon with 20,000 inhabitants 250 acres only are employed, giving 80 persons to the acre. At Edinburgh the sewage of 100,000 inhabitants is distributed over 340 acres, representing no less than 294 persons to the acre.

Quantity to be used.

17. A comparison of the population of these towns with that of Calcutta gives the following proportionate areas for the sewage of Calcutta:—

According to the rate of Worthing Calcutta will require	... 22,800	acres.
Of Sir J. Paxton	... 1,600	„
„ the London Market Gardeners	2,857	„
„ Croydon	... 5,000	„
„ the Earl of Essex	... 4,000	„
„ Edinburgh, the most profitable	1,400	„

From this it will be seen that Sir J. Paxton, the scientific Gardener, has calculated a rate which very nearly corresponds with the quantity employed in Edinburgh, where the pecuniary results were most satisfactory. It would be premature to pronounce what quantity will best suit the lands which the Company propose to reclaim.

18. Doubtless, the larger the area the more completely will nuisance be avoided, and a condition should be imposed reserving to Government the right of fixing the minimum over which each day's sewage shall be distributed.

Larger area preferable.

19. As to the beneficial effect of the application of town sewage to crops, the experiments on English land will afford no criterion of what is to be expected in this country: it will be sufficient to mention that it has been found to increase the productive power of land in an extraordinary degree. It must, however, be noted that the Commission find no record of its having been tried for other crops than grass, rye grass, and early potatoes.

Effect of sewage in increasing the productiveness of land.

Section VI.

Estimated cost of Works.

1. The Works designed for the reclamation of 25 square miles comprising the Salt Water Lakes, exclusive of the Tardah Jungle, are estimated to cost Rupees 9,45,080. Upon this subject the Commission have had the advantage of the evidence of Mr. F. Prestage, Agent of the Eastern Bengal Railway, and of Mr. J. O'Flaherty, Executive Engineer of the Calcutta Canals.*

Estimated cost of Works.

2. The principal works required to carry out the operations described in Section 2 above consist of 55 miles of main irrigating channels, contained within two embankments of an average height of five feet, and each 15 feet wide at top. It is intended that these embankments shall also exclude the tidal water from the Lake bed, but their position is only generally given on the map submitted. The next important item is 90 miles of minor irrigating channels to distribute the sewage from the main channels: 90 miles of drainage channels intermediate to the foregoing are also provided for the purpose of discharging the surplus irrigation water and rainfall.

Earth-work Estimates liberal.

3. These three items and one for the excavation of a channel to connect the mouth of the high level sewage at Tengrah with the central channel form the earth-work portion of the project, and the estimated cost of these is Rupees 6,79,800, or more than two-thirds of the entire estimate.

4. From the result of their enquiries and calculations the Commission fully coincide with the opinions of Messrs. Prestage and O'Flaherty, that this part of the estimate is liberal.

5. It is apparently intended to restrain the water in the natural channels which traverse the surface of the so-called Lakes by longitudinal lines of embankments; but it seems to the Commission that this course would create much unnecessary expense, and would be less convenient for the operations of the Company than the

Suggestion.

* *Vide* Mr. F. Prestage's replies to questions dated 1st June 1865 in Appendix VII., and Mr. J. O'Flaherty's ditto dated 5th June in ditto VIII.

erection of one outer line of embankment round the area to be reclaimed.

6. They therefore suggest that one continuous line encircling the whole area of the north Lake, and a similar line round the whole area of the south Lake be constructed. These should cross all the khals at the nearest practicable points to their mouths, and the principle khals should be provided with substantial tunnel sluices and self-acting iron flap gates, the sill of which should be placed at level of low water in the dry season, so as to ensure the effective drainage of the Lake bed. The khal channels would answer admirably as reservoirs for the reception of drainage water till it could be discharged at periods of ebb through the sluices. With this arrangement a great reduction in the size of the interior main irrigating channel embankments could be effected as they would not have to withstand any tidal pressure within the area protected by the marginal embankment. They could also be constructed from time to time as the irrigation process extended.

7. An embankment 15 feet wide, of an average height of 5 feet, surrounding the whole area of 25 square miles, would probably be 41 miles long, as roughly stated underneath. It will be observed that it encloses the north and south Lakes' area as it were by ring fences, and in the latter case includes that portion of the Tardah Jungle west of the navigation channel between Bamunghatta and Samookpotta :—

Embankment to surround South Lakes' area.

From Dhappa to Bamunghatta, west side of central channel	... 5	miles.
From Bamunghatta to Samookpotta on west side of channel	... 5	„
From Samookpotta to Eastern Bengal Railway Bridge below Gurreah along Tolly's Nullah	... 7	„
From South-Eastern Railway Bridge to north side of Punchunnogram Estate	... 7	„
		24

Embankment to surround North Lakes' area.

From Dhappa to Bamunghatta, east side of central channel	... 5	miles.
From Bamunghatta northward to Koorahpookorriah	... 5	„
From Koorahpookorriah to Dhokyndaree on new Canal	... 7	„
		17
Total	...	41

8. The object in carrying this embankment *round* the areas of both Lakes is to intercept the land drainage floods from Ballygunge and Dum-Dum, which, as recommended in Section II., paragraph 24, *et seq.*, should be discharged by catchwater drains independently of the reclamation area. The excavation of the catchwater drain would of course form the embankment.

9. Allowing this marginal line to have, as already stated, an average height of 5 feet, breadth at top of 15 feet, and slopes of 3 (not 2) to 1, it would, at the estimated rate, cost Rupees 4,752 per mile,* or Rupees 1,94,832. This, deducted from the sum provided for main irrigation channels, would still leave Rupees 3,13,368*a* for the gradual construction of these as their necessity became apparent, and a portion of this sum could certainly be applied to make up deficiencies in other items of the estimate without crippling the operations of the Company.

	Rupees.
a For irrigation channel ...	5,08,200
Marginal embankment ...	1,94,832
Total ...	3,13,368

10. After the earth-work, the next item of importance in the estimate is a lock chamber and gates the cost of which is underestimated at Rupees 11,480. This should be increased, in Mr. Prestage's opinion, to Rupees 35,000, and in this the Commission concur. The item next requiring notice is a dredger and two barges put down at Rupees 20,000; but this, in the opinion of Messrs. Prestage and O'Flaherty, should be increased to Rupees 35,000, in which also the Commission occur.

Estimate of machinery, &c., too low.

11. The item of 16 tide flap sluices—cost Rupees 64,000—will not, in the opinion of the Commission, be sufficient to provide adequate sluicing capacity for the drainage of the reclamation area. The number will probably have to be doubled, and the cost also, raising this item to Rupees 1,28,000. The rate for iron piping is taken at Rupees 100 per ton. This should be increased to Rupees 120 per ton, which will raise the provision for 135 irrigation sluices, and for syphons from Rupees 31,700 and Rupees 14,000 respectively to Rupees 32,100 and Rupees 15,800, making an aggregate increase in these two items of Rupees 2,200.

12. The items for 18 stop gates and for two engines, each 26-horse-power, respectively, put down at Rupees 36,000 and Rupees 1,00,000, require no alteration. It is noted in the latter case that engine-houses are understood to be provided in the charge for fixing.

The item (No. 4) for additional overflow wall may be omitted as unnecessary with reference to remarks in Section II. It amounts to Rupees 8,100.

13. There is a remarkable omission in the estimate in not providing for Secretariat and engineering charges and for contingencies. This is moderately estimated by the Commission at 10 per cent. upon the gross cost of the works.

Omission in Estimate.

14. The revised estimate will accordingly be as follows :—

Commission's Estimate.

ESTIMATE.

Number.	Items.	Original.	Revised.
		Rs.	Rs.
1	Excavation of channel between high level sewer and outlet 8,000 × 200=16,00,000	9,600	9,600
2	Lock chamber and gates with six 3-feet pentstocks in side of channel	11,480	35,000
3	Tide flaps and setting, each comprising ten tide flaps 3 feet diameter flats in brick wall 100 feet long, top level 12 feet above datum.		
	South side of channel, say 10 such sluices, at Rupees 4,000	40,000	1,28,000
	North side of channel, say 6 such sluices, at Rupees 4,000	24,000	

* Thus its sectional area $\frac{15 \times 45}{2} = 30 \times 5 = 150 \times 5,280 = 7,92,000$ cubic feet at Rs. 6 per 1,000 cubic feet=Rupees 4,752 per mile.

Number.	Items.	Original.	Revised.
4	Additional overflow wall, say 1,000 feet long, 9 feet high × 3 feet = 27,000, at 30 Rupees	Rs. 8,100*	Rs. ...
5	Stop gates for irrigating channels, leaving an opening 15 feet wide, lifting gates of wood, 2 crab winches, one on either side, brick wall and floor—		
	Say 10, south Lake, at ... Rs. 2,000	20,000	36,000
	,, 8, north ,, ,, ... ,, 2,000	16,000	
6	Two engines,—Messrs. Easton and Amos estimate each engine to lift ½ million gallons per hour 10 feet high, with spare parts, *viz* :—		
	Say in England £5,000		
	Freight and fixing ... £5,000		
		1,00,000	1,00,000
7	135 sluices and 100 feet of pipe to each 9" average diameter, with flap at end, at Rupees 200 each	27,000	
	Say 135 iron supports at 1½ cwt., 20 tons, at Rs. 100... Rs. 2,000		32,100
	Brick-work, &c., 135, at Rs. 20,120 ... ... ,, 2,700		
		4,700	
7a.	Syphon communication crossing central channel consisting of 6 pipes 2 feet diameter, each 60 yards long = 90 tons ... ... Rs. 9,000		
	Laying ditto in place, 120... ,, 5,000		
		14,000	15,800
8	Main channels for irrigation, two embankments 5 feet high, 16 feet wide at top, slope 2 to 1 = 250 feet extension per foot forward.		
9	Main drain may be taken at the same work 250 feet per foot = 13,20,000 per mile, at Rs. 6=Rs. 7,920 per mile. Sodding at 4 annas per foot ... ... ,, 1,320 ,,		
	Total ... Rs. 9,240 per mile.		
10	27½ miles, south Lake, at Rupees 9,240	2,54,100	3,91,580
	27½ ,, north ,, ,, ...	2,54,100	
11	Side irrigating channels formed of two embankments, each 3 feet wide at top, 2 feet high, slope 2 to 1 = 28 feet per foot forward = 1,47,840 cubic feet per mile = Rupees 900 per mile.		
	47 miles south Lake, per mile ...	81,000	81,000
	34 miles, north Lake, per mile ...		
12	Side drains and forming the land at same rate	81,000	81,000
	Dredger and Barges	20,000	35,000
	Rupees ...	9,45,080	9,45,080
	Secretariat and engineering charges and contingencies at 10 per cent ...	...	94,508
			10,39,588
		Annual.	
	Working Expenses.		
	These as provided for in Company's Estimate may be adopted	84,000	
	To which should be added—		
	Manager's salary, at Rupees 1,500 per month	18,000	
	Secretary and Office expenses .. 18,000		
	Directors' fees 12,000	30,000	
	Total Rupees ...	1,32,000	

15. The construction of the works according to revised estimate of Rupees 10,39,588 would entail an outlay of about Rupees 65 per acre on the 16,000 acres comprised in the northern and southern Salt Lakes : this is exclusive of the cost of purchasing the land.

Section VII.

Of the Financial prospects of the Company.

1. The Commission will follow the plan adopted in Mr. Clark's memorandum, which describes the intended operations of the Company and will first consider the project as if it embraced only the reclamation of the north and south Lakes.

Project first considered as embracing the Salt Lakes area only.

2. To fix the cost of purchasing 25 square miles of land in the two Lakes, the price of 19 square miles of Tardah Jungle, or 12,160 acres, must be deducted from the total of Mr. Heysham's estimate as given in Section IV. This will leave Rupees 7,13,600 as shewn in the margin. Adding to this Rupees 10,39,588, the cost of works and machinery, as estimated in the 6th Section above, the result is an outlay of Rupees 17,53,188.

Cost of land in the two Lakes.

Total of Mr. Heysham's estimate ...	Rs.	8,96,000
Deduct :		
Cost of 12,160 of jungle at Rs. 5 a beegah, or Rs. 15 an acre ...	Rs.	1,82,400
Remaining cost of Lakes	Rs.	7,13,600
Cost of works	,,	10,39,588
Total outlay ...	Rs.	17,53,188

3. To calculate the income it will be necessary to make a deduction from the gross area on account of the space occupied by drainage and irrigation channels and for other reasons remaining unproductive. As the embankments will be covered with grass which, so near Calcutta, will sell at a high rate, and as the khals will yield fishery rents, 10 per cent will probably be sufficient to deduct as unproductive, and this will leave a productive area of acres 14,400.*

Estimate of profits.

* Total area 25 miles or acres ...	16,000
Deduct 10 per cent.	1,600
Remaining acres...	14,400

4. When the land is thoroughly drained and embanked, and when sweet water for irrigation is completely under control, the Commission believe that, even if the lands were unenriched by sewage, there would be no difficulty whatever in obtaining a rent of 4 Rupees a beegah, or Rupees 12 an acre, which would give Rupees 1,72,800 per annum. But from this must be deducted Rupees 83,992, the amount of estimated working charges, leaving a net profit of Rupees 88,808 per annum, being 5·09 per cent. on the capital expended.

Minimum profit under the most unfavorable circumstances when the works are completed.

5. It will be observed that these calculations assume as data the most adverse circumstances which can reasonably be anticipated for the Company's project.

In the outlay every expenditure is provided for a thorough system of draining the lands, for irrigating them with sewage, and for getting rid of the Calcutta sewage in the manner to which the Company will be bound by their conditions; whereas in calculating the returns 12 Rupees an acre are assumed, a rate which the Commission feel confident the lands will readily command if they are merely embanked and drained without the benefit of sewage irrigation, and if no more valuable a crop than rice can be grown upon them.

6. There is reason, however, to believe that the Company's profits will far exceed this rate. In the absence of data in this country it is impossible to say to what extent the application of the sewage will raise the value of the lands; but, looking to the results in England, and bearing in mind that the lands will be thoroughly drained, and therefore made capable of producing the more valuable crops, the Commission do not consider the estimate of 6 Rupees per beegah or 18 Rupees an acre to be by any means unreasonable. That rate would yield annually Rupees 2,59,200, from

Much larger profits anticipated.

* This item the Commission consider to be superfluous.

which, deducting the working charges, Rupees 83,992, a net profit of Rupees 1,75,208, or rather more than 9·99 per cent. on the outlay of Rupees 17,53,188.

Financial prospects, including the Tardah Jungle, considered.

7. The Commission now proceed to consider what the result will be if the cost of the works and machinery is spread over the larger area obtained by including the Tardah Jungle in the Company's operations.

Cost of purchase. 19 square miles × 640 = 12,160 acres, at Rupees 5 a beegah, or Rupees 15 an acre = Rupees 1,82,400. Clearance.

8. The area of the jungle estimated at about 19 square miles being now unproductive, or nearly so, Mr. Heysham's estimate for purchasing all rights in it is Rupees 5 a beegah, making an aggregate cost of Rupees 1,82,400: to this must be added the cost of clearing the jungle, for which from 3 to 4 Rupees per beegah is now paid. Taking 4 Rupees, (as the extensive operations will probably raise the cost of labour,) the clearance of the whole area will be effected for Rupees 1,45,920. The wood will be valuable, being so near the Calcutta market, into which it will come gradually. Rupees 45,920 may be allowed as the net proceeds of its sale, reducing the actual cost of clearing the jungle to Rupees 1,00,000.

9. For the works it may be assumed that the land will merely be embanked so as to keep out the salt water, and drained so as to get rid of the surplus rainfall.

Cost of Works.

10. On the scale of the estimate given in Section 6 for the two Lakes, the cost of surrounding the 19 miles of Tardah Jungle with an embankment, and making such channels and sluices as will be required to keep the internal area thoroughly drained, may be thus roughly estimated—

	Rupees.
An embankment same size and length as that estimated in Section 6 to surround the Salt Lakes' area of 25 square miles, *viz.*, 41 miles, @ Rupees 4,752 per mile.....	=1,94,832
32 Self-acting tidal sluices similar in number and size to those provided for the Salt Lakes' area in Section 6, 32, @ Rupees 4,000 each.....	=1,28,000
	3,22,832
10 per cent for engineering and other charges	32,283
Total ...	3,55,115

11. The return would be 10,944 acres of land yielding 12 Rupees an acre, or Rupees 1,31,328. The total results of the whole 44 square miles would then be—

Outlay on the Lakes as above calculated	Rs.	17,53,188
Purchase of land in Tardah Jungle	,,	1,82,400
Net outlay on clearance of Tardah Jungle ...	,,	1,00,000
Embankment and drainage of Tardah Jungle ...	,,	3,55,115
Total outlay ...	Rs.	23,90,703

RETURNS.

On Lakes when irrigated with sewage, at 18 Rupees an acre ...	Rs.	2,59,200
On Tardah Jungle merely drained and embanked, at 12 Rupees an acre	,,	1,31,328
Gross Income	,,	3,90,528
Deduct 10 per cent. for collection charges and risks on the above ...	,,	39,052
Remainder	,,	3,51,476
Deduct working expenses, including Secretariat and management charges, say	,,	90,000
Net Income	,,	2,61,476

giving 10·93 per cent. on the outlay of 23,90,703 Rupees. If the sewage irrigation be extended to this area, and the more valuable crops successfully cultivated, the profit will of course be very much increased; but for this Mr. Clark supposes that an additional engine, &c., will be necessary, and he has made no calculations on which the Commission can found an estimate.

Opinion of Commission.

12. The conclusion to which the above figures lead is that the inclusion of the Tardah Jungle in the Company's operations is necessary to hold out such a prospect of high returns as will induce them to prosecute the scheme by which Calcutta is to be delivered from the noxious proximity of the salt marches.

Much higher rent for sewage lands expected by some persons.

13. It is proper to add that many persons are confident that the lands when irrigated with sewage will yield a much higher rent than 18 Rupees an acre. Among these is Mr. Armstrong, the Superintending Engineer of the Cuttack Circle, who has expressed the following opinion:—"If the lands are "properly tilled and irrigated with sewage "matter, and if they are cultivated so as to "yield two crops per annum, I consider "Rupees 30 per acre will be found to be the "value of these lands. I may add that under "the conditions I note I have no doubt on "this point."

14. In the absence of Indian data the Commission are not prepared to deny this; but they have thought it proper to adopt a more moderate rate in their calculations, of which the whole object is attained when it is shewn that there is a reasonable expectation of such a profit as will enable the Company to carry out their operations, and to fulfil the conditions as to sewage, &c., which will be imposed upon them.

SECTION VIII.

Consideration of the sanitary advantages and disadvantages to Calcutta to be expected from the proposed mode of reclamation.

Present state of the tract known as the Salt Water Lakes.

1. To form an idea of the advantages likely to result from the operations of the Company, it is necessary clearly to bear in mind the present condition of the Salt Water Lakes. The name it bears is apt to mislead: from the description given in Section IV. above, it will be seen that the tract known as the Lakes would be more accurately described as a marsh liable to frequent inundation: in certain depressed places only are standing sheets of water

to be seen: the water which forms these, and which, coming up the central channel, keeps the whole surface in a state of morass, is rather brackish than actually salt in the rains; at other times of the year it is more salt. Although the quantity of salt is such as to preclude the cultivation of the lands, fresh natural vegetation is not at once destroyed. Over the whole surface of the Salt Lake some sort of vegetation grows. In many spots it is of the densest character, a thick impenetrable jungle: in other places it is coarse grass growing through water. Where the land is naturally high, and where partial attempts at reclamation have been made, the ordinary pasture grasses of Bengal are met with and rice cultivation is carried on.

2. Of all marshes those near the sea, which are subject to alternate inundation by salt and fresh water, are the most unwholesome, because, according to one theory, the marine vegetation and animal life is destroyed by fresh water and *vice versâ*, so that a putrescent mass is constantly created, which poisons the air. It is possible that, if the tidal water which comes into the Lakes contained more salt, the effect might be still more deleterious than is even now the case. Be that as it may, the Salt Lake is a marsh subject to alternate inundation and exposure which cause the rapid decay of vegetation, from which malaria is plentifully evolved.

The Lakes shewn by experience to be most noxious to health. This is in accordance with the opinion of Dr. Watson.

3. One of the ablest Physicians of the day, Dr. Watson, gave the following opinion in a lecture, which is quoted in the foot note in page 28 of Dr. Hugh Macpherson's pamphlet on the mortality of Calcutta:—

"For producing malaria it appears to be requi-
"site that there should be a surface capable
"of absorbing moisture, and that this surface
"should be flooded and soaked with water
"and then dried; and the higher the tem-
"perature, and the quicker the drying pro-
"cess, the more plentiful and the more viru-
"lent (more virulent probably because more
"plentiful) is the poison that is evolved."

The surface of the Salt Lakes' marsh exactly fulfils these conditions, (the degree of drying varying according to the different levels of the surface,) and they are aggravated by the fact that the inundating water is brackish. The Commission learn from the Collector of Canal Tolls that of the Canal Officers and Peons who are stationed at Dhappa (about the nearest point of the Lakes to Calcutta) as many as 60 or 70 per cent. are frequently laid up with fever and ague at the close of the rainy season. It can scarcely be doubted that the malaria which has its origin here finds its way to Calcutta and causes much of the fever and ague which prevails at certain seasons of the year. Dr. Norman Chevers has collected the written testimony on this point from which the Commission select a few extracts:—

Dr. Ranald Martin.

"According to Sir J. Ranald Martin, those who
"frequent the borders of the
"Lake * * * to
"collect the reeds used for the manufacture of
"door mats in common use here are unusually
"short-lived, and in the season of the inunda-
"tion of 1833 most of them died."

Dr. Norman Chevers.

"The general opinion of the medical profession
"and even of the public has
"always steadily regarded
"those parts of Calcutta which lie eastwards
"towards the Salt Lake as being the un-
"healthiest in the neighbourhood. The ad-
"visability of shutting up the eastern sides
"of houses at night is a matter of ancient
"folk-lore in this city. Consequently those
"suburbs which lie between the Lake and
"the city have always been neglected and
"have become the resorts of the most wretch-
"ed classes of inhabitants and the sites for
"innumerable standing nuisances, knackeries,
"piggeries, burial grounds, tanneries, lay
"stalls, and the like, which, upon the recla-
"mation of the Salt Lake, will have to
"be removed (with vast improvement to the
"salubrity and comfort of the present
"suburbs) and re-established in more distant
"and appropriate sites."

Dr. Strong.

"Dr. Strong, Surgeon of the 24-Pergunnahs, wrote in 1837:—"As com-
"mon cause of the constant
"malaria that prevails here, I would mention
"the exposure of a vast expanse of wet mud
"on the receding of the tide from the Salt
"Water Lake, and I have visited many of
"the villages bordering upon the Lake and
"find the inhabitants, in point of appearance
"and health, to correspond very much with
"the state of those people who inhabit mala-
"rial and marshy lands. I found that much
"of the land which during the rains was
"covered with water has since been dry with
"jungle growing upon parts of it. * * *
"These lands being alternately wet and dry
"must be a constant and plentiful source of
"malaria."

And again—

"No one can doubt that a shallow, brackish, or
"salt marsh, extending, as the one in ques-
"tion does, over a surface of many miles,
"must be a source of much unhealthiness,
"particularly in a tropical climate, and that
"it must produce a contaminated atmos-
"phere, the bad qualities of which must effect
"the health, not only of those inhabiting its
"immediate borders, but also those residing
"in the neighbourhood for miles around it.
"That the neighbourhood of the Lake is
"really unhealthy, I believe, needs no proof:
"enquiry among the Natives of Balliaghat
"and other places similarly situated would
"satisfy any person in this respect. He
"would be told 'the air was very bad;' that
"the 'salt air was very bad,' and would find
"that sickness in those places more than
"commonly prevails."

In this very year the irruption of sea water over the southern part of the 24-Pergunnahs and Midnapore Districts was followed by a terrible sickness and mortality. The same thing occurred in 1833.

On the other hand, the Commission have before them the views of the Drainage Committee of 1857:—

Salt Lakes not considered so unhealthy by Drainage Committee.

"The Committee do not consider that any insa-
"lubrious effect is produced
"upon this town by the
"proximity of the Salt
"Lake, or by its position in the direction of
"the prevailing south-east wind. The air
"rushing in from the sea to fill up the partial
"vacuum caused by the rarification of the
"heated land air passes over the Soonderbuns,

"and at certain seasons becomes charged "with the malaria arising from decayed vege- "tation, and it is this which would produce "a deleterious effect on the climate of Cal- "cutta if it had not to come in contact first "with the watery expanse of the Salt Lake, "the briny surface of which in some degree "clears it of its impurities." They have also the opinion of Dr. S. G. Chuckerbutty, as expressed in his evidence, of which copy is annexed marked IX.

Nor by Dr. S. G. Chuckerbutty.

4. The Commission consider that the weight of evidence establishes the fact that the existence of the tract in its present state is most injurious to the health of Calcutta.

Opinion of Commission.

5. That the Salt Lakes are gradually silting up is a fact; but very many years must elapse before they disappear by natural processes, though aided by partial reclamations carried on by individuals.

Natural silting up of Lake.

6. The scheme of the Company is to dry up the surface at once and for ever to exclude the sea-water. As stated in Section 9, the Commission recommend that the Government make it a condition that the lands be first of all surrounded by an outer embankment and then thoroughly drained: this done for their own interest, the Company will bring the area into cultivation as rapidly as possible, and that is a great object to the public.

Object of Company.

Immediate cultivation desirable.

7. Dr. William Fergusson observes:—"It is "cultivation which acts by ever opening the "surface for the escape of pestilential gases, "and exhausting the morbific principle by a "constant succession of crops, for wherever "malaria prevails the uncultivated Savan- "nah, even though used for pasture, be- "comes infinitely more pestiferous than the "plantation, and the depopulated country "falls completely under its dominion. With "the aid of the purifying sea breeze this "course at the British Colony of Demerara, "within six degrees of the equator, has suc- "ceeded in rendering the cultivated portion "of the deepest and most extensive morass "probably in the world an healthy, fertile, "and beautiful settlement. I shall not here "enter into a detailed account of the asto- "nishing system of tide and flood gate drain- "age by which this delightful result has "been established and kept up."

8. Dr. Ranald Martin writes:—"It is not "sufficient to convert the "ground into a state of soft, "low meadow land, for the most dangerous "exhalations are those which are retained and "occasionally emitted from under a crust of "earth during the drying process, whereby "they would appear to acquire unusual con- "centration and prove the origin of the "worst fevers. It is necessary that the "grounds be thoroughly drained, leaving "none of the characters of the marsh, other- "wise it had better be left as it is."

Dr. Martin pronounces marsh land dangerous.

But the Commission observe that at the present day the question is not one of converting an existing sheet of water into a swamp: the surface to be dealt with is already exactly in the condition which Dr. Martin pronounces to be so dangerous. The drainage operations of the Company cannot make it worse than it now is, and, if the Company succeed in converting the marsh into valuable land, the advantage to the public will be inestimable. The benefit will be raised to the highest degree if the Company can carry out their intention of covering the land with other crops requiring dry soil; but even should they be driven to rice, it appears to the Commission that rice cultivation would be far preferable to the existing alternation of inundation with salt water and partial desiccation. Doubtless, the first operations will be dangerous to the health of those employed on the works, and for their protection precautionary measures must be taken.

Object of these operations to convert existing marsh into dry land.

Rice cultivation preferable to present condition.

9. The Company's scheme, if carried out, will substitute a cultivated and drained area for the present pestilential swamp and forest. It will save the Canals, which are peopled with hundreds of navigators, from pollution by having the sewage of the whole town thrown into it in one mass, and it will relieve the town from the dangers of having its sewage floating backwards and forwards in the Canal close at hand (for Mr. Leonard's experiments with floats established that the flood tide will bring back what the ebb carries down.) Under the most unfavorable circumstances when, in consequence of the heavy fall of rain, the Company are obliged to discharge the sewage through their numerous drainage channels into the Canal without letting it run over their lands (which at other times will absorb the offensive matter) the Canals will receive the sewage diluted in the highest degree, and discharged either at different points over a length of several miles, or at one point below Bamunghatta, 8 miles from Calcutta.

Public advantages to be derived.

10. To make sure of these advantages a condition must be imposed binding the Company under a heavy penalty to keep up arrangements which shall be amply sufficient to run off the sewage matter from the reservoir daily, whether they do or do not require it for their lands, and even though they should find insurmountable difficulties from local circumstances and Native ideas in the way of utilizing it on their lands. The sewage difficulty would probably be disposed of satisfactorily if the Justices carried out their contemplated scheme of utilizing it on a square mile or two of land, but the extended area available for the purpose in the Company's scheme would be a considerable advantage to the public. To secure the benefits which the project offers to the Calcutta public the Government would, in the opinion of the Commission, be fully justified in taking up the land of the private proprietors under Section 26, Act XXII. of 1863.

Certain conditions to be imposed.

Section IX.

Of the Conditions to be imposed.

1. The Commission have now given their opinion on the general bearing and effect of the proposed scheme as required in the 2nd paragraph of the Government letter No. 1972, dated 17th April 1865. They proceed, with reference to the 3rd and following paragraphs of that letter, to suggest the conditions under which the works should be undertaken. The points mentioned in

Section 15 of Act XXII. of 1863 will first be noticed.

2. First as to the provision and payment of the price of the land. It is desirable, before allowing the Company to be provisionally registered, that the Government should have a guarantee that they will not withdraw from the purchase of the land after the price has been fixed under the procedure of Act VI. of 1857. With this object the Commission recommend that the Company be required, under Section 15 of the Act, to deposit two lacs of Rupees; it should be stipulated that this amount shall remain intact while the proceedings for taking up the land are in progress; that any portion of the land which may be handed over to the Company shall be paid for by them without reference to this deposit; that the deposit money shall be at the disposal of the Government for the purpose of paying, if necessary, for any land which may have been taken up, and of meeting the expenses attendant on taking up the land, and that so much of the deposit as may then remain in hand shall be applied to the payment of the last instalment on account of purchasing the area of land applied for by the Company. The Company will perhaps prefer that the area should be taken up in convenient blocks: to this there can be no objection, for, if they reclaim the area of the north Lake only and there stop, the public will be benefitted to that extent. If, therefore, the Company desire that the proceedings for taking up the area of the north Lake be completed before those on the south Lake and Tardah Jungle are commenced upon, a much smaller amount of deposit will suffice. The principle of the condition which the Commission recommend is, that no proceedings for taking land in any block be taken until the Company have deposited at least a quarter of the estimated cost of that block.

3. It should be understood that this condition is imposed under Section 15 of the Act, and that it refers solely to the purchase of the land, and is entirely distinct from the demand of caution money for the execution of the works which is provided for by Section 17.

4. On this and the following conditions being accepted by the Company the project may be provisionally registered under Section 14. Then the formal agreements may be executed and the caution money deposited, as required by Sections 17 and 18 of the law, after which definitive registry under Section 18 may be effected. Then, as soon as the area which the promoters require or the block which they wish to be first taken up has been surveyed and the boundaries marked off, as contemplated in Sections 22 and 23 of the Act, the land should be taken up for the Company under Section 26 of the Act. All costs of the proceedings will be borne by the Company, including the salary of the presiding Officer, who will doubtless be employed for some months exclusively on taking up these lands.

5. Section 48 of the Act sufficiently protects the public from alienation of the land for objectionable purposes. All interests which the Company may create on the land will, of course, be subject to the lien of Government under the Act.

Conditions as to construction and maintenance of works.

6. Next as to the construction and maintenance of the works, and as to the operations.

Conditions connected with the reclamation of land.

7. With regard to the land, the first condition should be that the Company throw up an external embankment enclosing the south Lake as described in Section 6 above, within two years of the date on which they may be put in possession of the land and that they construct such sluices and drains as be necessary to keep the area entirely free from salt water. Simultaneously a catchwater drain must be made to carry off the water from the Ballygunge Suburbs, as described in the same Section. This done the Company will, in their own interests, carry on the internal works as rapidly as possible. This condition will not preclude the Company from enclosing any smaller portions of the Lake and making experiments on them.

8. The operations should commence first on the south Lake, with reference to the condition which it will be necessary to impose, (as detailed below) that immediate arrangement be made for carrying off the sewage from the reservoir near Tengrah, and discharging it into the central channel at the furtherest point from Calcutta, whenever the Company are unable or unwilling to use it on their lands.

9. The Company should be bound to make a similar embankment round the north Lake, with a catchwater drain for the drainage of Dum-Dum and the country to the north, and to make similar provision for its drainage before the end of the third year: it will of course be optional with them to operate on the two Lakes simultaneously

Purchase by Government of 100 feet of land in each side of the Canal recommended.

10. The Commission recommend that the opportunity be taken of purchasing for the Government a strip of land extending 100 feet on each side of the central channel to be reserved for Canal purposes. The Company's *general* line of embankment should be at this distance from the channel, but all necessary privileges as to landing places, and the means of drainage and irrigation, should be secured to them.

Lands to be ploughed up in the rains.

11. The lands once drained of salt water should be ploughed up for the first time in the height of the rains, (for, writes Dr. Martin, "it is during a certain stage of the "drying process that marsh exhalation is "most concentrated, and it has been observed "in many countries that the drying up of "brackish water is more injurious than that "of either salt or fresh alone,") and the surface of no more land should be disturbed than can be brought under immediate cultivation, for according to the same authority (and all others)

"a succession of crops purifies and evaporates "the soil and thereby obviates exhalation."

Dr. Martin objects to rice crops; but it has already been observed that even these would be better than the present state of the marsh. Crops not requiring so much moisture would doubtless be far preferable.

Tardah Jungle.

12. As to the Tardah Jungle, for the reasons given above, it should be stipulated that the operations commence within six years, and that no more

land be cleared each season than can be embanked and brought into cultivation at any rate during the following year. On no account should a large area be stripped of its forest and left in a state of naked salt morass.

Clearance and cultivation to be simultaneous.

13. Jungle which is not removed for sale as firewood should be burnt as soon as possible on the spot.

14. The right of prohibiting any particular crop or any particular operation which may be pronounced injurious to the public health should be reserved to Government.

15. These stipulations in addition to the provisions of Section 42 of the Act will suffice as far as the treatment of the land is concerned.

Conditions for protection of Calcutta Drainage.

16. For the protection of the drainage works of Calcutta the Justices wish to impose the following conditions:—

1*st*.—That sufficient weirs or overflows be provided between the natural streams and the reclaimed area of land to limit the maximum height of the water surface in these streams to a level of 12 feet above Kidderpore Dock Sill.

2*nd*.—That the positions and extent of these weirs or overflows shall be fixed by the Justices on receipt of a plan shewing the limit of the area over which the operations of the Company will extend.

3*rd*.—That the construction and maintenance of such weir or overflow shall be at the expense of the Company.

4*th*.—That the gates or sluices, &c., required at the lower end of the Canal leading from Tengrah to the central channel of the Lake shall be of such design as the Justices may approve, and shall be constructed at the cost of the Company.

5*th*.—That these sluices shall remain the property and be under the absolute control of the Justices.

6*th*.—For the use of this channel and of the sewage the Company should be required to keep it free from accumulations of deposit and perfectly free for the flow of sewage into the Lake channel when required by the Justices.

7*th*.—That such arrangements be made as shall prevent the surface level of the water into which the Tengrah high level sewer discharges from exceeding a maximum height of 12 feet above Kidderpore Dock Sill.

8*th*.—That all the works proposed by the Company, so far as they pertain to the outfall of the drainage and the use of their sewage, should be subject to the approval of the Justices of Calcutta.

17. The Commission have, in Section 2, expressed their opinion that the first of these conditions is unnecessary (and therefore all the second and third.) The Justices, however, have a right to insist on their being imposed as they give their sewage. The 4th and 6th conditions would apply to the channel which is stipulated for in paragraph 21 below as a means of running the sewage from the reservoir at Tengrah to below Bamunghatta whenever it is not required on the lands.

18. With this modification the Commission concur in the necessity of imposing the 4th, 5th, 6th, 7th, and 8th conditions: the words, "remain the property and" might be omitted from the 5th.

Conditions with regard to sewage.

19. With regard to the sewage, the following stipulations are recommended:—

Reservoir to be constructed at Tengrah.

20. A reservoir shall immediately be constructed (whether by damming up the Raja's Khall or by a fresh excavation) to receive the sewage at the end of the high level sewer at Tengrah, and for diluting it therein to such a consistency as may be necessary to enable it to flow through the Company's drains. (This arrangement will be necessary until the Calcutta Water-supply scheme is completed.)

Means of getting rid of sewage from Tengrah to be provided at once.

21. Such machinery, drains, and other means as the Government may consider necessary shall at once be provided to enable the Company without fail to clear their reservoir daily of the quantity of filth which it receives, and to convey it to a second reservoir at some point below Bamunghatta, from which it shall be discharged during ebb tide into the channel: any sewage which may not be sufficiently liquid to be discharged from Tengrah must be daily removed for utilization on the land or to Bamunghatta by such other means as the Government may approve. It is necessary to bind the Company strictly to remove all sewage from Tengrah *daily*, whether they require to use it or not, and to insist on the immediate execution of the works required for this purpose.

22. If the Company require it, it will be optional with them to diffuse the sewage over any lands from which the salt water has been effectually excluded, the Government reserving the right of fixing the maxium quantity to be deposited on a given area in a given time.

Deodorization.

23. On the subject of deodorization the Commission have expressed their views in Section 5 above. Before provisional registry, the right of insisting on deodorization, if found practicable, should be reserved to Government.

Right of Government to enter and execute necessary works.

24. There should be a stipulation that the Government on serving a notice of not less than fifteen days may enter upon the Company's land and execute any work they may deem necessary for the public health and security in the event of the Company declining to undertake such work, or, having undertaken, not completing it within a specified period; and that the cost of such work be recovered from the Company and be a prior charge to any other against the estate.

Belt of trees to be planted.

25. The Company should be bound at once to plant a belt of umbrageous trees of rapid growth between the Lakes and Calcutta: these would act as an absorbent screen from the malaria which the Lake in its present state evolves, and would counteract any increase of it which may be created during the operations.

Operations prejudicial to the health of those engaged.

Precaution suggested.

26. The first operations will certainly be prejudicial to the health of those engaged in them. The Commission can only suggest that especial care be taken to feed and house the workmen well, that

a medical man be employed solely to look after them, and that he be kept amply supplied with quinine and other necessary medicines. The coolies' huts should be well raised on bamboo or soondry piles, like the houses in Burmah and some of the Eastern Districts of Bengal. It will obviously be for the direct interest of the Company, who will require so much labour, to take every possible precaution for the health of their men.

27. Referring to the 4th paragraph of orders of Government, it appears to the Commission that it will only be necessary (in addition to the provisions of Section 49 of the Act) to impose one condition on the Company, to be enforced in the event of their winding up their affairs, or abandoning the works, *viz.*, that the Government shall have a prior right to take over, at cost price, any land which may have been made over to the Company, and that the land shall then come to Government free of all titles and interests which the Company may have created, and which the Government shall not think proper to confirm, the Company's Estate, and not the Government, being liable for any compensation which may be awarded by the Courts for the loss of such titles and interests. This stipulation would only hold good in the event of the Company's affairs being wound up in such a manner as to cause a cessation of the operations, and of the fulfilment of the other conditions imposed in the contracts.

Provision in case of Company's affairs being wound up.

28. It remains to consider the points referred to in paragraphs 6 and 7 of the Government orders.

29. In the course of years the progress of science and change of circumstances may make a radical change in the arrangements desirable, the Commission would therefore fix a limit of sixty years to the proposed contracts At the end of that time the Government should have the option of taking over the land and works at a fair valuation, and the right of the Company to the sewage should cease. If the Justices only, and not the Government, were to exercise their right, the Company would certainly be in a better position than any one else to pay them the market price which the sewage might then command.

30. Looking at the nature of the undertaking and the very great benefits which the Company will confer on the public of Calcutta, the Commission have no hesitation in recommending that within that period whatever profits it may yield should be left entirely to be enjoyed by the Company.

31. They believe that the Government will be justified, not only in making over to the Company free of cost the few acres of Government land which fall within the boundaries of the proposed operations, but in giving all countenance and support to a scheme which has for its object the deliverance of the Metropolis from the gigantic evils under which it suffers in consequence of Mr. Job Charnock's unfortunate selection of a site for the Factory a century and a half ago.

Appendix No. I.

Memorandum,—No. 3259, Office of the Superintending Engineer, South-Eastern Circle, Calcutta, the 27th April 1865.

The enclosed papers upon the subject of Salt Lakes' Reclamation are forwarded to the Executive Engineer of the Canals' Division, who is requested to give his early and most careful attention to the following points in the scheme which require full consideration in connection with the navigation of the Canal and Tolly's Nullah:—

1*st.*—It is proposed to exclude the tidal water from the Salt Lakes and confine it to the present navigation channel between Dhappa, Bamunghatta, and Samookpotta. What will be the effect of thus confining the flow and ebb of the tide to this channel? Mr. Clark admits in page 3 of his memorandum that "the scour of the channel is reduced in proportion to the diminished quantity of water admitted." It should, therefore, be a subject of enquiry how much tidal water will be excluded, and the probability, if any, of the navigation channel silting up from such exclusion.

2*nd.*—Mr. Clark's statements in page 1 regarding the depth of water in the Salt Lakes and also that of low water in the central or navigation channel should be verified.

3*rd.*—Mr. Clark further states, the bottom of the Lake, so far as it is at present known, varies but "slightly," and he assumes its lowest part as 8 feet over his datum, which is Kidderpore Dock. In another place he says, low water in Tolly's Nullah on southern margin of the Lake is 4 feet over datum with a rise of tide of about 12 feet, consequently high water in Tolly's Nullah would be 16 feet over datum, or 8 feet over bottom of Lake. This does not appear to agree with his statement in another place, that the depth of water in the Lake is 2 feet at deepest in the dry season and 3 feet in the rains, unless it can be shewn that Tolly's Nullah at high water is actually some 5 or 6 feet higher than the Lake surface.

4*th.*—Again, it is stated that central channel has a rise of tide of above 5 feet, and the level of low water at Dhappa is given in the dry season as 6½ feet over datum, which would make high water level 11½ feet over same, and this is expressly stated to be the case elsewhere. The inference, therefore, is that high water in Tolly's Nullah on southern margin of the Lakes is 4½ feet higher than that of the central channel at Dhappa: this should be enquired into and verified.

5*th.*—The statement that the depth of central channel is from 13 to 17 feet deep at low water should also be examined and verified, and a cross section of the channel below mouth of Raja's Khall should be submitted.

6*th.*—Reference should be made to old records to ascertain what effect the gradual silting up of the Salt Lakes has had in the central channel. It would appear from Mr. Prinsep's Note given in margin of Chief Engineer's memorandum of 25th February last that very considerable changes have occurred from this silting up process, and it is extremely desirable a comparison should be made between the central channel of the present day and what it was in 1830, or at an early period if practicable.

7*th.*—In addition to the fresh water at present poured from the Hooghly into the Salt Lakes through the canal, it is important to ascertain

what other fresh water streams flow into the Lakes, and thence into the navigation channel above Bamunghatta.

8*th*.—In the event of this Reclamation project being sanctioned, it appears desirable the Canal Authorities should have possession of a strip of land bordering both sides of the channel through the Lakes and Tardah Jungle, and also along that part of Tolly's Nunlah bounding the reclamation area. The breadth of these strips of land and their probable aggregate area should be reported.

9*th*.—It will be observed the only outlet proposed for the refuse sewage water is that at mouth of Raja's Khall. The present scheme as regards the Canal does not alter the provision already sanctioned by Government for the disposal of the Calcutta drainage, except in so far that it discharges the sewage in a more diluted and innocuous state. It might be as well, however, to enquire if a second outlet into Tolly's Nullah below the South-Eastern Railway Bridge might not be insisted on, not merely for the additional security to the Calcutta drainage, but for the convenience of the Canal navigation.

10*th*.—The Executive Engineer should communicate fully with the Collector of Tolls on these several points, and upon any others which may occur to him in the interest of the Canal's navigation, and submit his report on the same before 15th proximo.

Memorandum from W. SMITH, ESQ., C. E., Officiating Superintending Engineer, South-Eastern Circle,—(No. 84, dated the 9th May 1865.)

COPY of the above forwarded for information to the President of the Commission of Enquiry into the project of Salt Lakes' Reclamation and Navigation Company, "Limited."

Appendix No. II.

From J. O'FLAHERTY, ESQ., C. E., Executive Engineer, Circular and Eastern Canals and Akra Division, to the Officiating Superintending Engineer, South-Eastern Circle,—(No. A., dated the 20th May 1865.)

WITH reference to your memorandum No. 3259 of 27th ultimo, I have the honor to submit the following remarks and reports:—

2. The concluding portion of the memorandum directs that this report should be submitted before the 15th instant; but, with every desire to comply with your wishes, I have found it impossible to do so, owing to the many points in Mr. Clark's printed statement which I was called upon to examine into and verify: this involved a good deal of out-door work, which the season, and particularly the weather, such as it has been this season, rendered more than ordinarily difficult. You are also aware that I was laid up for some days in consequence of exposure on the Lakes on the 6th instant.

3. I was also instructed to make reference to old records bearing on the Drainage and Reclamation of the Salt Lakes; these books are not in the Canal Office and I only procured them on the 13th instant. However, I have gone very carefully into the whole matter, and I am in hope that the information I now submit will be found so full and accurate that the delay may be more than compensated for.

4. Herewith I submit a Statement shewing, with reference to Mr. Kyd's Dock gauge, the several levels of Captains Prinsep and Thompson, (extracted from the old records), of Mr. Clark, and my own from actual levels.

5. In 1857 I took levels from Dhappa to Tengrah Khall along the tow-path, at same time noting the land level inside: my starting point was the coping of the Dhappa Docks, and I find that that was also a B. M. of Mr. Clark's. In January 1860 I had to report on a proposed line of embankment from Dhappa to Dhakooreah along the western edge of the southern Lake, and I walked the whole distance through water and slush and made notes of the high water mark, rice land surface level, low ground, &c., &c.

6. Recently the late Mr. Boate took a section in the line of the proposed embankment above referred to, and I have been able to connect those levels with my own at Dhappa, so reducing them to Kyd's gauge.

7. On the 6th instant I explored another portion of the southern Lake in company with Mr. Browning and took some levels, which I have also connected with Kyd's gauge.

8. In January 1860 my reduced level of *highest* water-mark at Tengrah is 11 feet, and in May 1865 (5th instant) at Dhakooreah 11 feet 2 inches, and that is pretty close.

9. With reference to your paragraph 2, I may say that Mr. Clark's statement regarding the Lake is correct. I make the general level 9 feet. It may in some places run down to 8 feet, but the lowest part I found is 6' 6." But then this is not of large area. In fact, it is only a spot where three or four small khalls join. In 1858, on 13th August and 16th October, according to observations taken by Mr. Clark on a gauge fixed in the Lake at Tengrah, the highest water of the year was 11' 8," giving a depth of 2' 8" to 3' over the general level. On the 9th of this month, (May 1865,) from observations taken by Mr. Galiffe on the gange at Dhappa Dock, the highest water was 12' 3," and lowest 7' 1," giving a range of 5' 2," which quite verifies Mr. Clark's statement. Mr. Galiffe also corroborates Mr. Clark as to the depth of water at low water in the central channel ranging from 13 feet to 17 feet. I submit four cross sections taken by Mr. Archer between Dhappa and Bamunghatta. Cross section No. 1 does not shew the full depth stated by Mr. Clark, but then that is up near the Docks where there is a good deal of chur and siltings, but from Tengrah Khall downwards it becomes very deep. On the accompanying map I have marked the depths below low water as noted by Captain Prinsep in 1828, and those noted by Mr. Archer during the present month. From Dhappa to a distance of somewhat more than two miles southward the bed of the channel seems to be much about the same now that it was in 1828, but from that downwards there appears to be a much greater depth of water than was represented by Captain Prinsep.

10. As regards paragraph 3, I have already corroborated Mr. Clark as to the Lake levels.

11. Respecting Tolly's Nullah tides, Mr. Clark refers to Panspotta "on the southern margin of the area." On looking up the Office records I find Mr. Isaac had some levels taken from the mouth of this Canal at the Hooghly up to a point a short distance above Panspotta, and those levels are connected with Kyd's gauge. Low water at Panspotta is shewn as 4·60 or 4' 7½" on the Dock Sill, and Mr. Galiffe has noted a range of tide of 12

feet, or 16' 6" on the Dock Sill: this would give 4' to 4' 6" over the very highest water observed in the Lake, and 7½ feet over the general level of the Lake surface; so Mr. Clark's statement is here also verified. The banks of Tolly's Nullah at this place are very high, some 15 to 16 feet over low water. There is a khall from the Lakes into this channel near where the Railway crosses the nullah, but the Zemindar has a large regulating sluice across the khall by which he can keep out the tide, or drain his land, as he may require.

12. At page 2 Mr. Clark states, during the dry season the fresh water is found in Tolly's Nullah at a short distance to the east of the Railway: this is Panspotta. In March last Mr. Galiffe tested the water here: it was then fresh, but the people who live in the vicinity have assured Mr. Galiffe that for a couple of months just before the setting in of the rains the water is quite brackish and utterly unfit for irrigation purposes.

13. Your paragraphs 4, 5, and 6 have been replied* to in the foregoing remarks.

* *Vide* Map, Sections and Statement of Levels.

14. In reply to paragraph 7, there are no other fresh water streams which flow into the Lake, except perhaps portion of the surplus rain water and drainage from Ballygunge.

15. With reference to paragraph 8, Mr. Galiffe and I are of opinion that Government should reserve for canal purposes a marginal strip land 100 feet in breadth on each side; the aggregate area will be about 1,375 beegahs.

16. I think it would be desirable to have provision made for a second outlet, as suggested in your 9th paragraph; but there may be a difficulty at the site proposed at Panspotta, as the rise of tide there is so great. There is a khall in the southern Lake which runs from near Raja's Khall southwards and discharges into the main channel about one mile below Bamunghatta, and if a second outlet be found necessary, I think this would be a preferable site to that at Panspotta.

17. Mr. Assistant Engineer Archer with Mr. Browning explored a very large area of the northern Lake on the 16th instant to a village called Moorsghat† on the extreme inland verge of the Lake: it would seem that the northern Lake is rather higher than the southern Lake, for there was no water lodged though the surface was soft and slushy. I always was of opinion that that side was higher and produced a better kind of grass than the southern, for I have frequently seen hundreds of cattle swimming across the canal to graze on the northern side. All the population who live in these Lakes are fishermen, and during the dry season of the year they shut up the several khalls, &c., so that the tides do not play over the lands. If the several khalls were not closed, the whole surface of the Lake would be drained naturally at low water.

† *Vide* Map.

18. With reference to the quantity of tidal water that will be shut off by the embanking of the khalls, I have assumed Mr. Clark's areas. The high spring tides for five days twice a month spill over the lands to a depth varying from land surface level to nearly three feet, and this twice in twenty-four hours: so I have taken an average of 18 inches for the spill in the northern and southern Lakes and nine inches as the average on the Tardah Jungle.

19. The area of the northern Lake is 10·8 square miles, and gives the following average spill in cubic feet —

In one tide ..	451,630,080
„ twenty-four hours ..	903,260,160
„ a month (five days twice)	9,032,601,600
„ a year ..	108,391,219,200
The southern Lake area 14·25 square miles.	
In one tide ..	595,900,800
„ twenty-four hours ..	1,191,801,600
„ a month (five days twice)	11,918,016,000
„ a year ..	143,016,192,000
Tardah Jungle depth 9 inches, area 19·5 square miles.	
In one tide ...	407,721,600
„ twenty-four hours ..	815,443,200
„ a month ...	8,154,432,000
„ a year ..	97,853,184,000

20. According to Captain Prinsep the Tardah Jungle is not submerged, but I have seen the tide spread over it; and in 1859 I had some work to do just opposite to Samookpotta, and I am pretty sure the jungle at both sides is about the same level, and I have observed it submerged from 1 foot to 18 inches at high spring tides: just at that time some of the proprietors were clearing the jungle preparatory to cultivation about a mile or so west of Samookpotta, and I know they raised a bund along the edge of the main khall some 2 feet to 2½ high.

21. According to Captain Thompson the level of the highest tide at Tardah is 10 feet 8 inches on Kyd's gauge, but this cannot possibly be correct, for the highest tide at Panspotta is 16 feet 6 inches. The distance between the two points is four miles, and I do not believe there would be a difference in high tide levels of 5 feet 10 inches. Mr. Clark, in his printed memorandum, page 2, shews high water springs in the rains at *Mutlah* to be 12 feet 6 inches on Kyd's gauge, the very same as the very highest water level ever observed at Dhappa, so that the highest water at Samookpotta could not be lower than at Mutlah, from whence the tide comes directly up through the Biddiadhurry.

22. My own experience of the past 10 years in the Canals of 24-Pergunnahs and Midgellee Divisions leads me to believe that, by embanking the khalls, especially when they terminate in a "culde-sac," (as the central channel may be said to do so long as the Chitpore Gates are closed,) there is a tendency to rapid silting up. It has been seen that even when the gates are open and the Hooghly tide allowed to play through the canal this additional supply has not been efficient to scour the canal or keep the northern end of the central channel clear, and this supply has been, I believe, less effective since the branch cut was made from the Circular to the new Canal, as the Hooghly supply is divided and flows through both canals.

23. It is obvious that if from the embanking of the khals the bed should silt up, the navigation would ultimately be much obstructed; but it is to be seen, from what I have before stated, that in the past 30 years there has been no deterioration of the central channel. I think it very probable that there will not be any material rise (if any at all) in the surface of the lake streams by the proposed embankments, but I am quite satisfied that there will not be the same scour during the ebb as when the spill off the lands is available.

24. It is, I understand, in contemplation to carry out and complete the new canal into the Hooghly, (as projected some 10 or 12 years ago.) If this be done, probably the Hooghly tide, when allowed to play through both channels of the canals, may have the effect of scouring and keeping the head of the central channel clear, except just at the junction at Dhappa, where a chur will always be formed.

25. There can be no doubt that the existence of this large area of salt marsh so close to Calcutta has been detrimental to the health of the city population: it is easily drainable, the soil is very rich, and I believe that, after the tide has been excluded from it for one year, it would yield a most luxuriant crop.

26. According to Captain Thompson, the average level of the Lake was in 1834 5 feet 10 inches, whereas Mr. Clark (page 1) and I now make it 9 feet 0 inch, so that if Captain Thompson be correct the Lake has silted up some 3 feet in 30 years.

27. Colonel Anbury, Chief Engineer, in his Minute on Captain Prinsep's Memorandum, states that Captain Prinsep's base or zero is also "mean level of Lake"; this is 7 feet 4 inches on Kyd's gauge, shewing silting up from 1828 (or 36 years) of 1 foot 8 inches.

28. My *lowest* level of bed of Lake is 2 feet 8 inches higher than Captain Thompson's

29. As directed by you, I have most fully communicated with the Collector of Tolls, from whom I have obtained much valuable information as to ranges of tide, depth of channels, and other points embraced in your memorandum.

30. I think I have now replied to every single query and suggestion of yours. I have gone carefully through the Fever Books and collected all evidence bearing upon the reclamation of the Salt Water Lakes, and put them in a form which will enable you to take all in at a glance.

31. Mr. Galiffe will countersign this to verify the information embodied herein, and for which I have quoted him as my authority.

(Sd.) J. F. Galiffe,
Collector of Calcutta Canals.

Appendix No. III.

From W. Smith, Esq., Officiating Superintending Engineer of the South-Eastern Circle, to J. O'Flaherty, Esq., C. E., Executive Engineer, Calcutta Canals,—(dated the 20th June 1865.)

Pray let me have the following information at your earliest convenience:—

1. The distance to Samookpotta from Chitpore by Canals.

2. Distance from Hastings' Bridge to Samookpotta by Tolly's Nullah.

3. *Level of high water springs* at South-Eastern Railway Bridge (over Tolly's Nullah) ascertained from Bridge drawings as promised.

4. Sectional area of Tolly's Nullah at high water springs *under Hastings' Bridge.*

5. Sectional area of present lock chamber at Chitpore at same level.

6. Sectional area of *proposed* new lock chamber at same level of high water also. Kindly note your replies on opposite side and return this for reference sake.

From J. O'Flaherty, Esq., Executive Engineer, Calcutta Canals, to W. Smith, Esq., Officiating Superintending Engineer of the South-Eastern Circle,—(dated the 22nd June 1865.)

1. From Chitpore to Samookpotta, 15 miles.

2. Hastings' Bridge to ditto, 17 miles.

3. I have applied to Mr. Pendleton for this information, but have not yet received it. (Subsequently received with note of 28th June 1865, and attached to this.)

(Sd.) W. S.

4. The sectional area under Hastings' Bridge at high water spring tides is 1,540 feet, and the length of the abutments at tow-path level is 44 feet.

5. The sectional area at Chitpore lock with the water at same level as at Hastings' Bridge is 360 feet, and the length of the chamber is 60 feet.

6. Sectional area of proposed new lock with water at same level will be 515 feet, and the length of the chamber 120 feet.

From J. O'Flaherty, Esq., to W. Smith, Esq.,—(dated the 28th June 1865.)

I send you the South-Eastern Railway as also Boate's sections, and the information referring to the Railway Bridge, which I have only just received from Pendleton.

You will see that the Engineer, Mr. Shanks, says it can be relied on. I think he has himself taken the levels. His highest water over Kyd's Sill is 16·10 or 16'·1¼," or 4⅜ inches less than I assumed it from Isaac's section. Shank's lowest water is 2·75 or 2'·9" over Kid's Sill, giving a range of tide of 13·35 or 13'·4," and which I believe to be quite the case.

The Railway datum is 8'·3" *under* Kyd's Sill.

From A. G. Pendleton, Esq., to Arthur Shanks, Esq.,—(dated the 25th May 1865.)

Will you kindly give me this information, or some part of it, as early as possible?

CALCUTTA AND SOUTH-EASTERN RAILWAY COMPANY, "LIMITED."

From ARTHUR SHANKS, ESQ., to A. G. PENDLESON ESQ.,—(No. 102, dated the 27th June 1865.)

THE enclosed. I have no reliable data in my Office, and pressure of works has prevented my obtaining levels earlier for Mr. O'Flaherty. *However, he can depend upon those I now send.*

Calcutta and South-Eastern Railway Company's Agent and Manager's Office, Sealdah.

44·00 } The level of the rails over the bridge
*35·75 } which crosses Tolly's Nullah.
41·85 } The level of the bottom of the
*33·60 } girders.
24·38 } The level of the masonry tow-path
*16·10 } underneath.
24·35 } The level of *highest* water in Tolly's
*16·10 } Nullah.

The headway provided for boats at highest water.

11·00 } *Lowest water* in the nullah and the
*2·75 } bed of the nullah.

These levels with reference to the Railway datum or Kyd's Dock Sill.

(Sd.) J. O'FLAHERTY.

The 25th May 1865.

These levels have reference to *our datum.*

(Sd.) ARTHUR SHANKS,
Railway Engineer.

The 27th June 1865.

Appendix No. IV.

From H. L. DAMPIER, ESQ., President of the Commission for enquiring into the project of the Salt Water Lakes' Reclamation and Irrigation Company, "Limited," to the Chairman of the Justices of the Peace for the Town of Calcutta,—(No. 14, dated the 1st June 1865.)

WITH reference to the stipulation which the Justices have made that the Salt Water Lakes' Reclamation Company shall provide sufficient weirs or overflows between the natural streams and the reclaimed area of land to limit the maximum height of the water surface in those streams to a level of 12 feet above Kidderpore Dock Sill, the Commission for enquiry into the project addressed the following question to Mr. Anley :—

"A rise of the water in the surface level of
"the central channel to a height of 12 feet
"above datum can only occur at the height
"of a very high tide. Are you of opinion
"that at such a juncture any overflow at
"the proposed level of 12 feet, which could
"be provided in the embankment, would
"appreciably diminish the height of the
"water in the channel, that is to such an
"extent as to affect beneficially the outfall
"of the natural drainage of Calcutta."

"If not, what is the necessity or object of
"imposing on the Company a condition that
"they shall provide the proposed overflow
"between the natural channels and the re-
"claimed land of the Salt Lakes?"

Mr. Anley replies: "I am of opinion that these
"overflows will tend to prevent the surface
"level in the central channel of the Lake
"from rising beyond the level of 12 feet
"above datum: it is not intended that the
"top of these overflows be 12 feet above
"datum, but I understand that these over-
"flows are to be of such extent and so
"arranged that, during the time of heavy
"rain, the water running down the natural
"streams into the central channel and the
"storm-water from the town meeting a high
"flood tide and being retarded or kept back
"from flowing off, this water might find an
"exit into the reclaimed area in the same
"manner as it now does over the surface of
"the Lake, and thus preserve the surface
"level of the water from reaching a higher
"level than 12 feet above datum."

"The necessity of imposing this condition on
"the Company is important, inasmuch that,
"if this level of 12 feet is not preserved, the
"sewers during the time of heavy rain and
"high water in the River Hooghly will
"remain gorged, and the lower portion of
"the town will be liable to be submerged
"owing to the sewers not passing off their
"water quick enough into the canal and its
"continuation, the central channel of the
"Lake."

"The only obect the Justices have of imposing
"this condition is to preserve the present
"surface level of the central channel and
"not to allow any works to interfere with
"the free discharge of the rain water."

It has been urged, on the other hand, that no provision of the sort which could be made would have any appreciable effect in lowering the surface level of the body of water coming up the central channel under the combination of circumstances in which only that level would rise as high as 12 feet above datum. It is not denied that the object for which the Justices wish to enforce the condition is paramount to all other considerations; but if the means proposed are not such as will in any probability secure the object, it is obviously desirable not to impose on the Compauy a condition which will be most injurious to their own interests, and which will probably weigh unfavorably against the project when considered in its sanitary relation to Calcutta. The Commission will be glad if you will favor them with your own views on this point, and with those of any other Engineer whom you may think proper to consult.

The antique* figures are the levels in feet and decimal over Kyd's Sill.

(Sd.) J. O'FLAHERTY.

Appendix No. V.

From R. TURNBULL, Esq., Secretary to the Justices of the Peace for the Town of Calcutta, to H. L. DAMPIER, Esq., President of the Commission for enquiring into the project of the Salt Water Lakes' Reclamation and Irrigation Company, "Limited,"—(No. 477, dated the 5th June 1865.)

I AM directed by the Chairman of the Justices to acknowledge the receipt of your letter No. 14 of the 1st instant.

2. The condition to which objection is taken in your letter is one in which the greatest stress has been laid by Mr. Clark, who, in his double capacity as originator of the new system of drainage for Calcutta, and of the proposal to enclose a square mile of the area of the Salt Water Lake, had given great attention to the subject, and was in possession of data which enabled him to give a mature opinion thereon.

3. In the importance of that condition the Chairman fully concurs. The one great advantage for selecting the Salt Water Lake as the outfall for the sewerage and drainage of the town is the continuity of the discharge of any system having its outfall into the Salt Water Lake, and it is of the utmost importance this continuity should be secured.

4. The Chairman is not prepared to acquiesce in the objection that no provision to enforce this condition which could be made would have any appreciable effect in lowering the surface level of the central channel, and he would certainly most strongly object to the withdrawal of the condition until its alleged inutility has been fully demonstrated after most mature consideration, and after a reference to Mr. Clark on the subject.

5. It may be observed that no objection has been raised by the Salt Water Lakes' Reclamation Company to the imposition of this condition, and that in a sanitary point of view the evils, if any, which may arise from its enforcement must be of rare occurrence, and far less injurious than those arising from the present state of the Salt Water Lake.

Appendix No. VI.

QUESTIONS FOR G. ANLEY, Esq., C. E., RESOLVED ON AT THE 4TH MEETING OF THE COMMISSION.

Questions.—1. Being acquainted with the details of the project of the Salt Water Lakes' Reclamation Company, "Limited," and with the proposed Calcutta Drainage system, are you of opinion that the Company's works, if carried out as proposed in Mr. Clark's memorandum dated February 1865, will interfere with the Drainage scheme?

2. In paragraph 4 of a memorandum dated the 27th February, drawn up by Mr. Clark as Engineer to the Calcutta Justices, that gentleman estimates the entire quantity of drainage from Calcutta at 24 million gallons per day, exclusive of storm-waters. Are you of opinion that this estimate is sufficiently high?

3. With reference to paragraph 7 of the same memorandum, assuming that the heaviest rainfall for 24 hours in Calcutta will amount to 60,000 cubic feet per minute, what portion of this quantity can the high level sewer discharge in the 24 hours in addition to the 24 million gallons of sewage, &c., mentioned in the question above?

REPLIES BY MR. ANLEY.

Answers.—1. No; so long as the main condition which the Justices have imposed is adhered to, this condition being that of not allowing any works to be undertaken that will prevent the free discharge of the storm-water during the rains, or tend to raise the surface level of the Canal and its continuation, the Salt Water Lake Channel, or in any way disturb the existing conditions of this outlet.

2. Yes. It is ample. Mr. Clark, in fixing the maximum water-supply at 12 million gallons, supposes that in 24 hours the entire quantity will find its way into the sewers, which is not likely to be the case.

His doubling that quantity gives a very large margin for the night soil, &c., from the city and for the water drawn from the river in the process of flushing the drains.

3. This is represented by the safe maximum quantity that the high level sewer is capable of discharging minus the 24 million gallons of sewage; and is again dependent upon the capabilities of the engines required to pump this sewage matter into the high level sewer. By the safe maximum quantity, I mean the quantity that would give that safe depth of stream in the sewer without injury to that sewer.

Fixing this depth at four feet three inches, the area of the stream will be 18·3875 feet; the velocity will be 205 feet per minute, and discharge 226·074 cubic feet, 14·12·962 gallons per hour or 33·911·088 gallons in the 24 hours.

This quantity therefore, minus 24 million gallons, or 9·911·088 gallons, would be the quantity of rain water that the high level sewer would discharge in the 24 hours.

The Engine and Pumps that are to be used to pump the sewage into the high level sewer are two in number, each capable of raising half million gallons per hour, and there is also an additional Engine and Pumps which also will be capable of raising half million gallons per hour.

But from the nature of this question of the Commission, I infer that it is presumed that the high level sewer is considered to be an outlet for storm-water during heavy rains, but this is not the case.

Mr. Clark, in his memorandum dated 30th May 1861, being a reply to a letter addressed by Mr. Longridge, C. E., to His Honor the Lieutenant-Governor of Bengal, states—

"The works are laid out on the following "principles:—

"The outfall for heavy storm-water is entirely "natural by gravitation; that for the dry "weather is entirely artificial by pumping."

This high level sewer is only provided to carry off the sewage matter that is pumped up into it; and not as an outlet for storm-waters.

4. Supposing the sewer to be discharging to the maximum of its capability, would the discharge raise the surface level of the central channel of the Lake after that channel has been restrained by embankments, as proposed by the Company, and if so, to what extent?

4. Much would depend upon the distance the embankments are from the edge of the bank of the central channel.

I am of opinion, however, that it would tend to raise the surface of the central channel, but to so slight an extent that it would scarcely be appreciated.

I am supposing that the Company have embanked the channel, but are not utilizing any of the sewage matter that the high level sewer is discharging.

Having no longitudinal or cross sections of the central channel, I am unable to state to what extent it would raise the surface level of the channel.

5. How will the surface level of the central channel be affected by receiving (in the manner proposed by the Company) the discharge of the high level sewer, or rather so much of it as will find its way into the channel after the matter brought down by the sewer shall have been made use of for purposes of irrigation, as proposed by the Company?

5. The surface level of the channel would not be at all affected if the Company utilize the sewage matter which the high level sewer will discharge to the extent they propose. I perceive their estimate includes two engines, each capable of raising half million gallons per hour; half the quantity that the high level sewer would discharge in the dry season would be disposed of, and, presuming that the other half would be discharged into the central channel, it would not be sufficient to cause any preceptible or appreciable rise in that channel.

6. The Calcutta Justices have proposed to impose on the Company a condition that arrangements shall be made to prevent the water in the Company's channel and reservoir rising beyond 12 feet above datum (Kidderpore Dock Sill) by providing an overflow; we observe that the Company's scheme contemplates that all water escaping over this overflow shall flood their reclaimed lands; do any means occur to you by which this flooding of the lands could be avoided?

6. Yes, by having a sufficient number of pentstocks provided in the gates which the Company propose to have at the end of their channel and reservoir to enable the water in their reservoir and channel to escape into the central channel, or by arranging their gates in such a manner as would admit of the water, when it reaches the height of 12 feet at the mouth of the sewer, flowing over the gates through gratings into the central channel of the Lake.

But the Calcutta Justices have not imposed the condition that this channel or reservoir shall be provided with an overflow.

"That such arrangements be made as shall "prevent the surface level of the water into "which the high level sewer discharges from "exceeding a maximum height of 12 feet "above Kidderpore Dock Sill."

But they impose, *vide* Condition 1*st*, that sufficient overflows or weirs be provided between the natural streams, which, of course, includes the central channel and the reclaimed area, so that the surface level of these streams shall not exceed 12 feet above datum, and so provide that, if these streams do rise above 12 feet above datum, their surplus water shall flow over the area of the reclaimed land. I do not think that any means can be adopted to prevent this flooding of the reclaimed area.

7. Whenever such flooding is unavoidable, do you consider that it would be injurious to the reclaimed lands, and to what extent?

7. No; I do not consider it would be injurious.

The flooding of the lands would only be likely to occur during the rainy season, and then only during the continuance of heavy rain, which would bring a large amount of fresh water down the canal and central channel, and thus flooding would only be likely to occur during the spring tides. The large admixture of the fresh water brought down by the canal and other different channels which receive the drainage of the lands surrounding the Salt Water Lake, mixing with the salt water brought up by the tide, would, as Mr. Clark observes, tend to dilute the salt water and render it innocuous to the reclaimed lands.

I have observed upon the coast of Orissa lands on which rice and other crops, which are chiefly grown during the rainy season, flooded to a depth of from one foot to two feet with salt water brought up through the different channels by the tide, mixed with the drainage water of the surrounding lands, without in any way damaging the crops upon that land. And I have also seen during the dry season crops upon the banks of a tidal river irrigated with the brackish water which the tide brings up, and the land does not appear to deteriorate by such flooding or irrigation.

8. Do any conditions occur to you which it will be desirable to impose on the Company, in addition to those suggested by Mr. Clark, with the object of securing the proper working of the Calcutta Drainage scheme?

8. No. I think the conditions suggested by Mr. Clark are sufficient to secure the proper working of the Drainage scheme. I infer, of course, that Condition No. 8 includes the subjecting, for the approval of the Justices, all plans and detail drawings of their works and operations: if this is not intended in Condition No. 8, it would be advisable to make it a separate condition.

9. If the Company's project be not carried into effect, in what manner do the Justices propose to dispose finally of the solid matter which must of necessity find its way into their sewers?

9. To answer this question clearly I must explain the system of the drainage.

The four main or receiving sewers which receive the drainage of the collateral sewers all join and empty their contents into one large sewer called the outfall sewer. At the end of this outfall sewer are the silt pits, two in number: these silt pits are so arranged that the sewage matter will remain for a time in a state of quiescence, and so enable the more solid matter, such as is likely to choke the pumps, to settle at the bottom of the silt pits.

When there is an accumulation of this solid matter, or at stated periods, boats will be brought into the silt pits through gates at their ends, and the solid refuse put into them carried down the canal, and finally discharge their cargo into the central channel.

G. A. D. Anley, C. E.,

Offg. Engineer to the Justices of the Peace.

QUESTION PROPOSED BY THE COMMISSION OF ENQUIRY INTO THE PROJECT OF THE SALT WATER LAKES' RECLAMATION AND IRRIGATION COMPANY, TO MR. ANLEY, C. E., ENGINEER TO THE JUSTICES OF CALCUTTA.

A RISE of the water in the surface level of the central channel to a height of 12 feet above datum can only occur at the height of a very high tide: are you of opinion that at such a juncture any overflow at the proposed level of 12 feet, which could be provided in the embankment, would appreciably diminish the height of the water in the channel, that is, to such an extent as to affect beneficially the outfall of the natural drainage of Calcutta. If not, what is the necessity or object of imposing on the Company a condition that they shall provide the proposed overflow between the natural channels and the reclaimed land of the Salt Lakes?

H. L. DAMPIER,

President of the Commission.

REPLY.

I AM of opinion that these overflows will tend to prevent the surface level in the central channel of the Lake from rising beyond the level of 12 feet above datum: it is not intended that the top of these overflows be 12 feet above datum, but I understand that these overflows are to be of such extent and so arranged, that, during the time of heavy rain, the water running down the natural streams into the central channel, and the storm-water from the town meeting a high flood tide, and being retarded or kept back from flowing off, this water might find an exit into the reclaimed area in the same manner as it now does over the surface of the Lake, and thus preserve the surface level of the water from reaching a higher level than 12 feet above datum.

The necessity of imposing this condition on the Company is important, inasmuch that, if this level of 12 feet is not preserved, the sewers during the time of heavy rain and high water in the River Hooghly will remain gorged and the lower portion of the town will be liable to be submerged owing to the sewers not passing off their water quick enough into the Canal, and its continuation, the central channel of the Lake.

The only object the Justices have of imposing this condition, is to preserve the present surface level of the central channel and not to allow any works to interfere with the free discharge of the rain water.

G. A. D. ANLEY, C. E.,

Offg. Engineer to the Justices of the Peace.

Appendix No. VII.

EVIDENCE GIVEN BY F. PRESTAGE, ESQ.

1st JUNE 1865.

I. Do you consider that the estimate of Rupees 9,45,080 shewn in the 6th page of Mr. Clark's memorandum is sufficient for the proper completion of the works provided for in that memorandum?

Taking the Estimate as a whole, I do consider it sufficient; but I observe that no provision has been made for management and supervision during the construction of the works. I consider the cost of these items would be in excess of the Rupees 9,45,080, and I would add a lac of Rupees on that account.

II. In how long are you of opinion that the works in the north and south Lake for which Mr. Clark has estimated, can be completed?

I think the period of three years which Mr. Clark has adopted is sufficient.

III. Taking the items of Mr. Clark's estimate in detail, what is your opinion of No. 6 for the engines?

I consider the estimate most liberal, amounting to nearly £ 100 per horse on the power.

IV. Looking at the work which the engines will have to do, do you not consider that it will be necessary to have a spare engine to take the place of either of working engines when out of order?

It would be more prudent to have such a spare engine, but I do not consider it absolutely necessary to the safe working, provided that duplicates of the working parts are provided.

V. What is your opinion on items 7 and 7*a* for iron-work?

I consider the estimate of Rupees 100 per ton to be fair for such castings.

VI. Do you consider that the estimate of Rupees 20,000 in item 12 will purchase a Dredger and Barges such as will be required for the dredging mentioned in page 4 of the memorandum?

I would add 50 per cent. to this item, raising it to Rupees 30,000.

VII. Do you consider that the provision of Rupees 11,480 in item 2 is sufficient for a lock chamber and gates to admit even a small Dredger?

I do not. I would add 200 per cent. to this estimate, raising the item to about Rupees 35,000.

VIII. Do you think the provisions in items 1, 8, 9, 10, 11 and 12 for earth-work sufficient?

I do, and I consider that the estimate under these heads is so liberal as to leave ample margin to meet the deficiency in the estimates for the lock chamber and gates, and for the Dredger and Barges. It should also go a long way towards covering the cost of management and supervision.

IX. Are you of opinion that Mr. Clark has, in his memorandum, provided for every thing which will be necessary for properly carrying out the objects which the Company have in view?

I have not critically examined the scheme so as to be in a position to give an opinion on minute details, but I see no obvious omission of importance.

Taken June 1st 1865.

(Sd) H. L. Dampier,
President.

Appendix No. VIII.

Evidence given by J. O'Flaherty, Esq., Executive Engineer, Calcutta Canals' Division.

5th June 1865.

I. Do you consider that the estimate of Rupees 9,45,080 shewn in the 6th page of Mr. Clark's memorandum is sufficient for the proper completion of the works provided for in that memorandum?

Taking the estimate as a whole, I consider it a little short.

II. Does any item occur to you as having been altogether omitted?

No percentage has been allowed for contingencies. I would add 10 per cent. to cover contingencies, management, and supervision. No other item occurs to me as having been omitted in Mr. Clark's estimate.

III. In how long are you of opinion that the works in the north and south Lake for which Mr. Clark has estimated can be completed?

The provision for the cost of earth-work is so liberal that the Company will have no difficulty in commanding labour sufficient to complete the works, not only on the south Lake, but also in the north Lake within two years.

IV. Do you consider that the estimate of Rupees 20,000 in item 12 will purchase a Dredger and Barges such as will be required for the dredging mentioned in page 4 of the memorandum?

I think not. Decidedly not. The Dredger now in use in the Canals cost Rupees 55,000, and each of its Barges about Rupees 4,000. With these prices before me, I would estimate Rupees 30,000 for such a light Dredger as the Company will require, and Rupees 2,500 for each Barge, Rupees 35,000 in all.

V. Do you consider that the provision of Rupees 11,480 in item 2 is sufficient for a lock chamber and gates to admit even a small Dredger?

Not at all sufficient. I consider that at least Rupees 20,000 would be necessary for the construction of two pair of lock gates with a chamber between of such dimensions as would be required to admit a Dredger into it. This is a rough calculation founded on the supposition that the chamber will be about 20 feet broad and 50 feet long.

VI. In the items of Mr. Clark's estimate regarding which no question has been put to you in detail, does any thing strike you as palpably over-estimated or under-estimated?

None. I have been into the details of prices of iron and brick-work, but I wish it to be distinctly understood that I have no data on which I can offer an opinion as to whether the quantities estimated for by Mr. Clark will suffice for the purposes which are contemplated.

VII. Are you of opinion that Mr. Clark has, in his memorandum, provided for every thing which will be necessary for properly carrying out the objects which the Company have in view?

No omission strikes me. I have not critically examined all the details, but in those items in which I have tested Mr. Clark's estimates and levels, I have found them so accurate that I feel confidence in his statement as a whole.

VIII. To what extent do you consider that the provision for earth-work is over-liberal?

I think the earth-work may be done for at least one Rupee a thousand less, which will leave a margin of the above 90,000 Rupees.

IX. After reading to you the question which has been put to Mr. Anley as to the necessity of, and advantage to be gained from, providing the overflows at 12 feet above datum in the natural streams communicating with the central channel, and the letter No. 14, dated 1st June, which the Commission have addressed to the Chairman of the Justices on the same subject, you are requested to state your opinion on the point.

I do not believe that the provision of overflows and weir walls will affect the level of the water in the smallest degree under the circumstances described.

The imposition of the condition would be most injurious to the Company, as it would allow the salt water to spill over the reclaimed lands: my belief is that the embanking of the sides of the central channel will scarcely, if at all, affect the surface level of the water in it.

X. It occurs to the Commission that provision should be made for intercepting the natural drainage from the suburbs about Ballygunge and discharging the same direct into Tolly's Nullah; and of similarly intercepting and discharging, into the central channel or some khall outside the reclaimed area, the drainage which at present finds its way into the northern lake from the neighbourhood of Dum-Dum, with a view to relieve the pumping engines of the Company during the period of storms. Be good enough to give your opinion of the advisability of this measure?

I think the proposed measure is desirable for the Company, feasible and comparatively inexpensive. The arrangements should be such as to place the water under the control of the Company, to be let into or shut off from the reclaimed area as they may require.

XI. With reference to the opinion which you have expressed, in reply to the written questions proposed to you by the Commission, to the effect that scour, down the central channel, will be decreased by embanking out the water from the reclaimed area, are you of opinion that this diminution of scour will increase the tendency of the Canal to silt to such a degree that it is desirable, in the interest of the navigation, to impose on the Company any condition as to dredging the Canal?

No.

Taken June 5th 1865.

(Sd.) H. L. Dampier,
President.

Appendix No. IX.

Evidence given by Dr. S. G. Chuckerbutty.
12th June 1865.

1. Be good enough, with reference to the letter which you addressed to the President of the Commission on the subject, to explain the nature of your objections to the project of the Salt Water Lakes' Irrigation and Reclamation Company?

My objections were based on the understanding that the drainage of the Lake was intended to be effective for a part only of each year, (*vide* paragraph 7 of a memorandum by the Solicitor to the Company dated 14th February 1865,) and that during the rains the bunds were to be cut to allow the water of the periodical inundations to flow over the reclaimed lands and thus restore them to the condition of a Lake.

Water cover is safer than exposure and stirring up of organic sediments in reference to the generation and escape of malaria, for it shuts out, in proportion to its own depth, light, heat and air, all of which with moisture are requisite to

putrefactive decomposition, and all of which will be annually brought into play by the reclamation scheme.

2. The turning up of the muddy soil, and its manuring and irrigation with the sewage and animal excreta from Calcutta, will spoil the air flowing over it infinitely more than is the case now.

3. All fresh and salt water Lakes have a natural tendency to permanently drain themselves by silting up, and this process is so rapid from the muddy waters of the Hooghly that, within the memory of living men, vast portions of the Salt Lakes have already been reclaimed in this way from the Circular Road to their present boundaries.

4. This natural, permanent, and most perfectly safe mode of reclamation of the Salt Lakes will be entirely interfered with by the temporary reclamation, which will leave them bare of water for several months of the year and by so much diminish their silt.

5. The present evil, we know, operates only during the east wind, and it is no more than the east wind causes whenever it prevails. the evil we are flying to can alone be measured by the vast expanse of the Lakes which, re-inforced by the sewage and animal excreta of Calcutta, will vomit forth its mephitic gases without let or hindrance to swell the death train of the terrible east wind of all ages and climates.

6. Objection is given in paragraph 8 of a memorandum I now hand in.

7. Objection is given in paragraph 9 of above memorandum.

8. Objection is given in paragraph 10 of above memorandum.

2. Are you aware that at present the portion of the Lake, which is in reality a permanent sheet of water, is very small indeed? that the greater portion is continually subject to the flooding and drying to which you so strongly object?

Yes; but the same amount of evil does not proceed from it as would be caused by the repeated stirring up of the mud for the purposes of cultivation and the daily distribution of the required sewage of Calcutta.

3. But if the scheme be that the artificial drainage and pumping off of rain water from the reclaimed area are to be continuous through the whole year, would not your objections be very much reduced?

If this continuous drainage be effective, then I have no objection to offer to the scheme, provided that the sewage and animal excreta are thoroughly disinfected before they are applied to the land.

4. But if no attempt be made to disinfect and deodorize the sewage, should you object?

In that case I think that the sanitary evil which the scheme professes to remedy would be increased. The sewage run on to the lands as proposed will combine all the conditions of decomposition as stated in the objection marked No. 3 in the memorandum I put in.

5. Would your objection hold good if the sewage were run on lands covered with grass?

It would.

6. Have you read the result of the experiments which have lately been made at Edinburgh, Carlisle, Worthing, Croyden, and other English towns in which the sewage has been run on to fields in the neighbourhood of the towns exactly as is proposed in the present case?

I have read some of the accounts; but I believe that the direction of the wind as regards the town and the irrigated fields, as well as the distance from the fields to the town, will determine whether the effects are injurious or not.

7. What are the sources of information on which you have stated that the Salt Lake is rapidly silting up?

I have been given to understand that Mr. Hugh Fraser has brought into cultivation portions of the Lake which have silted up by a natural process, and I have heard it mentioned at different times that the Lake has silted up, but I cannot at present name my informants.

8. The present sewage system of Calcutta which cannot now be interfered with, provides for the collection of the whole sewage matter at Tengrah. Assuming that for various reasons it is

I would suggest that it be carried down as far as the Mutlah below Port Canning in a tunnel. I should even say that the burying of the dry sewage matter at Tengrah, if practicable, would

not practicable to get rid of this collection by letting it flow away through the natural channels, what mode of disposing of it would you suggest as preferable to that of the Salt Lakes Company?

9. Are you not of opinion that the present state of the Salt Lakes is most prejudicial to the health of Calcutta?

be preferable to the proposed scheme of spreading it out in a liquid state.

No; for the reasons stated in the 1st and 2nd paragraphs of my memorandum now put in.

Taken on the 12th June.

(Sd.) H. L. DAMPIER,
President.

Extract from a Note by DR. S. G. CHUCKERBUTTY, *referred to in his evidence before the Commision.*

PARA. 8.—The Salt Water Lakes Reclamation Company does not propose to meet these difficulties* by permanent draining, nor is its capital sufficient to warrant it to undertake so gigantic a work.

* Referred to in paragraph 5 of the evidence.

9. If the Salt Lake territory is allowed to gain height by its inundations with river water, and if periodical inundations with rain water must still continue, then is it not wiser to abstain from meddling with those salt and river water inundations for the ultimate and permanent draining of that bed?

10. The temporary draining may certainly yield some crops remunerative or otherwise, but that doubtful benefit will be dearly paid for by an increase of malaria and by mischievous interference with the grand silting operations of nature. The whole delta of the Ganges is an alluvium which has been gradually built up in this way, and if the tilling of the rice fields throughout Lower Bengal, where they are subject to annual inundations, does not help to raise them one iota, it is not to be expected that the agricultural operations of the *Salt Water Lakes Reclamation Company* will effect any thing more. This is a geological truth, not to be upset by the paltry capital and scheme of the Company, but yet capable of being materially advanced by following nature in her own track and adding solid matters to the silt which deposits itself from the water.

Report on the Garrow Tribes on the Frontier of Gowalparah.

From CAPTAIN B. W. D. MORTON, Deputy Commissioner of Assam, to the Personal Assistant to the Commissioner of Assam,—(No. 156., dated Gowalparah, the 6th May 1865.)

I HAVE the honor to submit, for the information of the Commissioner, a condensed report of my late tour along the Garrow Frontier. In immediate connection with the report I shall explain the steps which I have already taken towards establishing the system of Hill Police alluded to in the Commissioner's letter to my address of the 27th August last. In a future report I propose to shew what remains to be done in giving effect to the instructions of Government (*vide* letter No. 2881, dated 18th November 1262, from Officiating Junior Secretary to the Government of Bengal, to the Commissioner of Assam,) regarding the jurisdiction to be exercised by the Deputy Commissioner of Gowalparah over the Hills bordering on Shooshung and Sherepore.

2. I left Gowalparah *en route* to the Frontier on the 13th of January last. In the course of my tour I visited the several Hâts or Garrow Markets on the Gowalparah side, commencing with Damrah on the east.

In pursuance with arrangements previously made, I was met at Damrah by the several Garrow Lakhirajdars of Habraghat, who hold lands rent-free under the Hills bordering on that Pergunnah and by the Nuzzuranah Chiefs of the Frontier Hills, stretching from the District of Kamroop on the east to the Pergunnah of Metchparah on the west.

3. After leaving Damrah I marched by Jeera to Nibarree. This is one of the most important Stations on the Frontier; the market being frequented by numbers of independent Garrows. I was here met by the Metchparah Zemindaree Garrows of the Nibarree Dowar.

4. Passing by the Hât of Luckeepore, Bangalkhatta, and Tikri Killa the next place of importance I visited was Singmari. This being the Head-Quarter of the Garrowan Surburakar is the usual rendezvous for the Khas Garrow Chiefs of the Dussanni and Choyanni Dowar, for the Chiefs of the Kurribarree Zemindaree Mehals, and those of the Nuzzuranah Mehals bordering on the Pergunnahs of Kalloo Mallooparrah, and Kurribarree. These Chiefs, with a few exceptions, met me at Singmari.

5. It was my intention to have marched from Singmari straight to Dalloo the last village in the District; but on learning that I should find it easier to travel across the Hills from the Mymensing side, I marched *vid* Mankorchur, Kurribarree, and the Sherepore Frontier to the banks of the Nattai close to where the river emerges from the Garrow Hills in the Pergunnah of Shooshung.

6. After I had completed the enquiries, to which I propose in a future report to refer, I proceeded by seven marches across the Hills to Singmari, and returned to the Station of Gowalparah by the usual route, resuming charge of my office on the 27th February. I wish to lay before the Commissioner at this stage of my report the necessity there appears for securing for this District during the two or three months annually spent by the Deputy Commissioner on the Garrow Frontier the services of an Assistant vested with full powers.

I believe the duty of visiting the Garrow Frontier to be the most important which devolves upon the Deputy Commissioner of Gowalparah. There will always be a fear, however, of that duty being hurriedly performed when the Officer in question knows that every day's delay adds to the arrear of work in his Office.

Other Deputy Commissioners in Assam can regulate the season and the duration of their Mofussil tours with reference to the state of their files. The Deputy Commissioner of Gowalparah in proceeding to the Frontier must take advantage of the only season in the year when he can hope to meet a large number of Chiefs, and to do Justice to his work he must remain out at least six weeks.

7. I proceed to the consideration of the system proposed by the Commissioner, and sanctioned by Government, of a rough Police for the Hills.

This system is not entirely new as Mr. Scott so far back as the year 1824 applied for sanction (*vide* letter dated 30th December 1824) for the annual disbursement of Rs. 1,020 as rewards to those Garrow Chiefs acknowledging the sovereignty of our Government, who during the year had maintained the peace of their respective jurisdictions. On receiving the sanction of Government, Mr. Scott whilst he took written agreements from all Chiefs (Appendix A,) submitting to Government in the form of Appendix B, for reasons which I am unable to trace, applied his plan of payment for specific service to those Garrow Chiefs only whom I have specified in the margin.

Luskur of—	Rs.	A.	P.
Dar Dollunggiri ...	83	7	7
Dar Boyragee ...	73	2	4
Dar Chipuk ...	41	12	9
Dasgram ...	60	0	0
Dar Harreegram ...	52	4	0
Dar Shathjowar ...	52	4	0
Dar Tikree ...	52	4	0
Dar Jowallee ...	52	4	0
Dar Damulgiri ...	31	5	7
Dar Pora Khasoos	50	0	0
Dar Bachoorparah	10	7	2
Dar Gandooparah ...	50	0	0
Dar Choyani ...	40	0	0

The sum of Rs. 1,020 per annum still remained sanctioned, and the savings from this head were, until lately, carried to deposit. Under order of the Accountant-General the actul expenses incurred on account of money payment to Garrow Luskurs are now charged against this sum.

8. In my interview with the several Garrow Chiefs I have spoken of, I did my utmost to impress upon them the wish of Government to entrust them in their Hills with the same duties, with special reference to the apprehension of offenders, as devolve upon the Police in the plains.

I explained to them that with a view of giving consequence to the office I propose to create, it would be well were the Luskurs of small contiguous jurisdictions to appoint one or more Chiefs as Police Zimmadars within certain defined limits.

I told them that the Zimmadar would be responsible simply for the peace of the tract placed under him, and that I should still look to each Luskur for the payment of the Nuzzur or Revenue for which he had, in the first instance, agreed to be answerable.

In fact, I did my utmost to make the office of Zimmadar, for the maintenance of peace, distinct from that of Luskur for the payment of the Government dues, and to explain to those concerned that the reward for good service during the year would, in the event of peace having been maintained, be invariably paid without the slightest reference to the revenue due from the Mouzahs composing the tract under any Zimmadar.

Lastly, I ventured to say that I would urge Government to allow Zimmadars to exercise the same powers as those with which the Jynteah Dollyes are vested in regard to trivial offences occurring within their respective jurisdictions.

9. The Garrow Chiefs whom I met, all expressed their willingness to accept the responsibility of apprehending criminals within their own village limits; some of them said, however, that they could not bind themselves to pursue offenders into independent territory, at the same time they all agreed to do what they could even in this respect.

As I have already stated it must be remembered that Garrows never forgive any injury. I fully believe that the unwillingness of the Chiefs to pursue and capture offenders in independent territory arises not from a feeling of inability to do so, but from a fear of the consequences which may result years and years afterwards.

10. The Luskur who are already in receipt of the Police allowance I have spoken of, and the seven Chiefs of the Nibarree Dowar, begged to be confirmed as Zimmadars over their respective jurisdictions. The Chiefs of the Nuzzuranah Dowars took my advice as to the appointment of one or more Zimmadars over tracts including several Mouzahs.

11. I have the honor to submit a list (Appendix C) of the Zimmadars who, with the consent of the Garrows, would, I believe, undertake the responsibility of maintaining the peace within certain defined limits. These limits are well known on the spot, though not recorded in any of our Maps. I also submit a rough draft of a Sunnud, which, on the part of Government, I should like to present the Zimmadars (Appendix D.) Believing myself authorized I gave those Zimmadars, who undertook the duties for the current year, Umulnamahs drawn up, with two exceptions, in the same terms as the Sunnuds of which I speak.

In the Umulnamah I made no mention of any magisterial power to be exercised by the Zimmadar, and I inserted a clause to the effect that the approval of my arrangement rested entirely with Government, who would fix the rate of remuneration to be paid to each Zimmadar in the event of peace having been maintained, or all offenders having been delivered up in the course of any one year.

12. It remains for me to state the remuneration which, under such circumstances, I would assign to the several Zimmadars. I have included this in Appendix C. The system which I have endeavored to sketch may be said to be an extension of that introduced by Mr. Scott, inasmuch as I contemplate the Garrow Zimmadars exercising a jurisdiction independent of the Police.

So long as the Zimmadars acted up to their agreement, I would not allow the Police to interfere with the Hills in any way.

Furthermore, Mr. Scott did not formally vest the Garrow Luskur with the power of disposing of even trivial cases, though at the same time there can be no question that it is a power which they have all along exercised.

The duties of the Zimmadars being thus more onerous than those devolving upon the Luskur appointed by Mr. Scott, it may perhaps be allowed that the scale of remuneration proposed by me is not too high.

13. If the Government approve of the Sunnud of appointment referred to in the 11th paragraph I would, with all deference, suggest that the same should be granted with some degree of eclât.

The Sunnuds might be printed on uniform paper with gilt edging. If the expenses should not prove too great a sword or baton of office, the gaudier the better, might be given to each Zimmadar, and if Troops or Police were available a small Detachment might accompany the Deputy Commissioner on his presenting the Sunnuds on the part of Government. The Garrows might be invited to witness the ceremony, and those who chose to attend might be feasted at the expense of Government.

Appendix A.

Statement exhibiting the Names and relative Population of the Dowars or Divisional of the Tributary Garrow Country, the Names of the Luskurs, and the Salary it is proposed to assign to each for Police duties.

Names of Dowars or Divisions.	Names of Luskurs.	Number of Houses taxed.	Revenue in 1820.	Proposed Annual Allowance.	Remarks.
Formerly attached to Karrocbanee.			Rs. As. P.	Rs. As. P.	
Dolimgiri ...	Agging ...	Not ascertained	700 0 0	80 0 0	These Divisions are of considerable extent, being from 30 to 6 miles in length, from 20 to 3 in breadth; most of the houses taxed are inhabited by several families, and probably contain on an average at least ten individuals.
Buragee Dooar	Soncha ...	184	925 0 0	70 0 0	
Dusgang	Soobul ...	127	635 0 0	60 0 0	
Tikree	Pagla ...	60	294 0 0	50 0 0	
Pora Kuswa	Tyrong ...	70	335 0 0	50 0 0	
Sateyooar	Thosong ...	50	248 0 0	50 0 0	
Bachoorparah	Abooja ...	14	70 0 0	10 0 0	
Towbe	Thoossong ...	93	377 0 0	50 0 0	
Gandooparah	Myaram ...	66	263 8 0	50 0 0	
Harugong	Khansama Kerval ...	94	374 8 0	50 0 0	
Dunulgiri	Kewal ...	Not ascertained	200 0 0	.....	The allowance of the Luskurs may appear too small with reference to the extent of country over which each of them preside; but as their public duty will not materially interfere with their private occupation, and as the value of money in the Hills is higher than Bengal, the sums stated seem to me to be sufficient.
Cheepook	Iabia ...	... ...	.....	40 0 0	
Formerly attached to Metchparah.					
Tikree 2nd	Assong ...	104	416 0 0	50 0 0	
Hatoogang	Sumbhoo ...	129	442 0 0	50 0 0	
Nibarree	Amon ...	98	320 0 0	50 0 0	
Formerly attached to Kalloo Mallooparah.					
Dusaunee	... ...	Not ascertained	196 0 0	40 0 0	
Chowanee	... ...	... ...	180 0 0	40 0 0	
Attached to Habraghat.					
Western Division	Dhunsing ...	... ...	.....	50 0 0	
Central Division	... ...	... ...	.....	80 0 0	
Eastern Division	... ...	... ...	.....	70 0 0	
		Total ...	.....	1,020 0 0	

(True Copy,)
A. C. Campbell,
Personal Asst. to Commr. of Assam.

(True Copy,)
B. W. D. Morton,
Deputy Commissioner.

(Sd.) D. Scott,
Commissioner.

Appendix B.

Form of Agreement taken by Mr. Scott.

I, having been appointed Luskur of Mouzah named below, with the general consent of Ryots, do hereby, of my free will, declare that I shall remain subject to the British Government, and pay Rupees Nuzzuranah for the Mouzah specified below.

2. I shall assess and collect rents from Ryots at the rate prevailing in the Mouzah, and pay Nuzzuranah either into the Sudder Station or the Surburakar's Cutcherry. I shall never pay without receipts; all allegation of payment without receipts will be considered invalid. Any order of alteration of jumma I shall attend to. If any Officer on the part of Government happens to be in my jurisdiction I shall assist and guide him till he reaches another Illaqua. When a criminal case occurs I shall report the matter to the Police or the Fouzdaree Court, and I shall assist in its investigation. If I fail, I shall be subject to any order that may be passed.

3. It was customary with us to murder human beings and hang their skulls in our houses. I shall henceforward discontinue the practice and shall not allow any of my subjects to do the same. If any one adheres to his former practice and commits murder, I shall apprehend and bring him to justice.

4. Human skulls were used to be hung up in our houses. This practice shall be discontinued in my Illaqua. The contrary being proved, I shall be subject to any punishment awarded.

5. If an escaped offender happens to come within my jurisdiction, I shall apprehend and bring him to justice.

6. I shall annually pay the Nuzzuranah either in the Sudder or Surburakar's Cutcherry and abide by the foregoing rule; in case of failure our houses will be assailed by Sepoys and our property destroyed, for which any claim on my part will be groundless.

I shall keep the boundaries of my Mouzah unaltered.

(True Translation,)
(Sd.) B. W. D. Morton,
Deputy Commissioner.

(True Copy,)
A. C. Campbell,
Personal Asst. toommr. of Assam.

Appendix C.

Name of Zimmadar.	Mouzahs under each Zimmadar.	Boundaries of the Tract.	Rate of remuneration proposed for good service.	Rate allowed by Mr. Scott.	Remarks.
			Rs.	Rs.	
Boga Luskur, of Bachooparah, Pergunnah Korreebaree.	1	North—Dar Dallung Giri. South and East—Marshy River of Sherepore. West—Dar Poora Kha Sooah (jurisdiction of Rottee Luskur.)	25	10	
Rakha Luskur, of Ishkalleekona, Mehal Nuzzuranah.	1	North—Rumfojora Mono Giri (Nuzzuranah,) and Boodo Giri, (Bemalna.) South—Sherepore. East—Nittai Nuddee. West—Dar Chipuk (jurisdiction of Jabra Luskur.)	80	...	Formerly claimed by the Sherepore Zemindar and not included in Mr. Scott's arrangement.
Jungrang Luskur, of Dajingparah.	1	North—Metchparah. South—Jurisdiction of Reektan Luskur of Raksam. East—Jurisdiction of Audit Luskur. West—Metchparah.	25		
Rungsan Luskur, of Mouzah Seeshim.	1	North—Jurisdiction of Reektan Luskur of Raksam and Metchparah. East—Jurisdiction of Ramjung Luskur of Rishoo.	25	...	Mr. Scott calculated 50 Rupees for Nibarree Chiefs, which, however, for reasons I am unable to state, was never paid by either himself or by any one succeeding him.
Rajon Luskur, of Shamkhalah.	1	North—Ram Singparah. South—Khosengparah. East—Seeshim. West—Khosengparah.	25		
Rashim Luskur, of Kholoyparah.	1	North—Khodangparah and Shamkhalah. South—Khama Giri (Nuzzuranah.) East—Gocool Giri (Nuzzuranah.) West—Thoshengparah.	25		
Khelchang, of Narain Khole.	1	North—Metchparah. South—Bakshoo. East—Bishoo. West—Raksham Dajingparah.	25		
Riktoon Luskur, of Raksham	1	North—Dajingparah. South—Seeshim. East—Bakshoo. West—Seeshim.	25		
Seemin Luskur, of Goocool Giri.	1	North—Seeshim and Bakshoo. South—Kamadan Giri (Bemahia.) East—Bakshoo and Akharoo. West—Kholoyparah.	25		
Ejing Luskur, of Damrah.	3	North—Habraghat. South—Durput. East—Bardaggul. West—hgungma.	25		

Name of Zimmadar.	Monzahs under each Zimmadar.	Boundaries of the Tract.	Rate of remuneration proposed for good service.	Rate allowed by Mr. Scott.	Remarks.
			Rs.	Rs.	
Ramchung Luskur, of Magaun. Thamalchang Luskur, of Damal Giri.	10	North—Habraghat. South—Mangshang. East—Adeep Giri in Kamroop. West—Gandun and Dewan's Illaqua.	60	...	Mr. Scott similarly calculated Rupees 200 as rewards for Police service to the Luskur of the Western, Central, and Eastern Division of Habraghat, but, for reasons which I cannot trace, the reward was never paid by either himself or by those who succeeded him.
Dingkhal Luskur, of Shamsheng. Ading Luskur, of Bor Madang.	5	North—Habraghat. South—Jurisdiction of Thoksaul. East—Bor Madang and Dewan's Illaqua. West—Chirran and Bor Daggal.	40		
Shalket Luskur, of Shungnea. Ramjing Luskur, of Rishoo.	9	North—Habraghat. South—Shamin and Shangkhorna. East—Bor Daggal. West—Rak Sham.	60		
Dewan Luskur, of Chibunga. Arasing Luskur, of Mejal Giri. Ranang Luskur.	10	North—Habraghat. South—Dambo and Rangjang. East—Jamal Giri and jurisdiction of Rachang Luskur. West—Mijal Giri, Ading Gii .	65		
Rejang Luskur, of Dar Tikree Madang Giri, Pergunnah Mechparah	14	North—Mechparah. South—Dar Dushauni and Manga Giri (Bemahia.) East—Hadogang. West—Dar Dushauni and Kallo Malloopparah.	50	50	
Rajing Luskur, of Dar Hatogram, Ramshingparah.	7	North—Metchparah. South—Khoma Giri. East—Jamada Giri (Bemahia.) West—Sengaparah in Dar Tikree.	50		
Ruttee Luskur, of Dar Poorakhasoon.	...	North—Dush Gram and Tikree East—Dalung Giri and Basoorparah. South—Sherepore. West—Poora Khasooah Hât.	60	50	
Rajin Luskur, of Durjowallee.	...	North—Kellunkee River. South—Kullo River. East—Gandooparah. West—Dhanooah and Sing Marree.	65		
Manoo Luskur, of Gandooparah.	...	North—Kullunkee. South—Mohatran Khannabarree. East—Balloopparah. West—Dar Jowarrie.	60	50	
Rojan Sirdar, Mungul Giri.	4	North—Shathoo Giri and Dar Dushani. South—Garrowan Giri, Shorap Giri, and Hattyram. East—Bemahia. West—Gandooparah and Dar Choyanni.	30	...	Not included in Mr. Scott's list.

Name of Zimmadar.	Mouzahs under each Zimmadar.	Boundaries of the Tract.	Rate of remuneration proposed for good service.	Rate allowed by Mr. Scott.	Remarks.
			Rs.	Rs.	
Jung Sing Luskur, of Dar Choyauni.	...	Boundaries of Dar Choyauni. North—Kalloo Mallooparah and Dar Dushauni. South—Kullunkee Nuddee. East—Dar Dushauni and Mungul Giri. West—Kalloo Mallooparah. Boundaries of Mouzah Shalloo Giri and Seena Giri. North—Boja Giri, Rungken Giri. East—Bemahia. South—Worran Giri. West—Dar Choyauni and Dar Dushauni.	50	40	
Sollung *alias* Ranglein Sirdar, of Masooa Giri.	4	North—Shorap Giri and Garowan Giri. South—Dar Dollung Giri. East—Bemahia. West—Dar Hurrugram and Damal Giri.	30	...	Not included in Mr. Scott's list.
Malung Luskur, of Dar Dushauni.	...	North—Dar Tikree and Metchparah. South—Dar Choyauni. East—Bashde Giri (Bemahia.) West—Pergunnah Kalloo Mallooparah.	50	40	
Jabra Luskur, of Dar Chipuk.	...	North—Dollung Giri. South—Sherepore. West—Dallo. East—Jurisdiction of Gandi Luskur.	60	50	
Han Sing Luskur, of Dar Harreegram.	...	North—Balloopparah (Nuzzurannah) South—Kalloo Nuddy and Dal Damal Giri. East—Shorap Giri and Garowan Giri. West—Coochparah.	60	50	
Shellam Luskur, of Chachaparah, Dar Boyragee.	...	North—Kalloo Nuddee and Dar Damal Giri. South—Dushgram and Poora Khasooa. East—Dolun Giri. West—Shattee Jowar.	80	70	
Daja Luskur, of Dar Dasgram.	...	North—Dar Boyragee. South—Poora Khasooah. East—Ditto ditto. West—Dar Tikree.	70	60	
Munga Luskur, of Dar Shattee Jowar.	2	North—Hât Pooteemaree and Kalloo Nuddee. East—Dar Boyragee. South—Dar Tikree. West—Durni River and Ben.	60	50	
Illong Luskur, of Dar Damal Giri.	1	North—Harreegram. East—Dollung Giri and Garrowan Giri. South—Dollung Giri and Dar Boyragee. West—Dar Harreegram and Dar Boyragee.	40	30	

Name of Zimmadar.	Mouzahs under each Zimmadar.	Boundaries of the Tract.	Rate of remuneration proposed for good service.	Rate allowed by Mr. Scott.	Remarks.
			Rs.	Rs.	
Nokool Luskur, of Dar Tikree, Pergunnah Kurreebarree.	1	North—Pharree Tickree and Shuttee Jowar. South—Pharree Poora Khasooah. West—Bahadoor Katta Hât and Low Chuprain Sherepore. East—Dar Dushgram.	60	50	
		Total Rs. ...	1,405		

Besides the above the following will, I hope, accept the responsibility of Zimmadar next year. Owing to the Frontier not having been marked off on the Mymensing side, it appeared to me to be useless to attempt an arrangement with the Garrow Chiefs east of the Nittai River.

Names.		
Asin, heir to the Luskurship of Dollung Giri, Pergunnah Kurreebarree.	...	The Illaqua of the Dollung Giri is one of the largest in the Garrow Hills. Asin, the rightful heir, is young. My predecessor, on the Luskurship falling vacant, appointed one Jong Sing to act until Asin had grown up. On my visit to the Frontier last year Asin was still diffident as to his fitness for the office.
Rashan Luskur, of Dama Giri, Khas Nuzzurannah.	...	This Luskur was unable or unwilling to meet me last year. The apprehension of the Sirdar of Serrap Giri on a charge of murder had probably some thing to do with his absence. The Sirdar of Rungnaba Giri informed me that he considered Rashan qualified to be Zimmadar of Rungnaba Giri and Dama Giri.
Nijjan Sirdar, of Chepra Giri.	...	This Sirdar was also, and for the same reason, probably as that given above, absent. He is an influential man and would, I believe, accept the Zimmadarship of Chepra Giri, Sellbal Giri, Rampha Giri, and the remaining parrahs of Garrowan Giri. With reference to the Luskurs I speak of I merely suppose that the apprehension of the Sherap Giri Sirdar may have alarmed them. I have no doubt I shall meet them next year.

As rewards for the performance of Police duties in the above Luskurships I believe the following sums would be adequate, *viz.* :—

	Rs.	Rs.
Dollung Giri	90	80
Dama Giri	25	0
Chepra Giri	50	0
Total ...	165	80

Two Mouzahs, *viz.*, Duggul in the Nuzzurranah Illaqua bordering on Habraghat, and Sherrap Giri, in the Khas Nuzzurranah Illaqua bordering on Kurreebarree and Kalloo Mallooparah, in which murders were lately committed, are not included in the list given above. The murderers having been captured I expect to effect similar arrangements with regard to them, and shall endeavor to have them included in neighbouring Zimmadarships. This may be found impossible, in that case it would be necessary to allow the Luskurs at the lowest rate, or as follows:—

	Rs.
Bor Daggal	25
Serrap Giri	25
Total ...	50
Grand Total ...	1620

(True Copy,)
(Sd.) A. C. Campbell,
Personal Asst. to Commr. of Assam.

(Sd.) B. W. D. Morton,
Deputy Commissioner.

Appendix D.

You are informed that in accordance with the wishes of an assembly of Luskurs you have been appointed Zimmadar of Police within the limits given below. The Government have been pleased to vest you with criminal powers as regards the trial of all petty offences and with civil powers in trial of all suits the value of which do not exceed Rupees 50.

The following Rules are laid down for your guidance, and you have given a written agreement setting forth your willingness to abide by the same :—

1*st*.—You will administer justice impartially and in strict accordance with your village customs.

Should you, during the year, carry out these rules attentively, you will receive from the Deputy Commissioner on the part of Government a sum of Rupees ; this will be paid you at a time and place to be fixed, and of which you will be yearly informed by the Deputy Commissioner.

2*nd*.—You will try to maintain peace in your own jurisdiction. Should any person of those under you, or Garrows of other Illaquas be guilty of any crime of a heinous nature within your jurisdiction, you will do your best to apprehend and bring the offender to justice.

3*rd*.—You will not allow any person of a different Illaqua or from the plains to overstep your jurisdiction and commit murder or other heinous crime on the hills or the plains. Should such happen you will do your best to apprehend the offenders and bring them before the Court of the Deputy Commissioner.

4*th*.—It was customary upon the death of a Chief to sacrifice a human being or to burn human remains on the funeral pile; you will on no account permit such practices within your own jurisdiction, and you will in every way exert yourself to dissuade and prevent the same in other Illaquas and should your remonstrances not be attended to, you will report and assist in apprehending the offenders.

5*th*.—You will after enquiry report to the Deputy Commissioner all accidental deaths, such as those from bites of snakes, fall from a tree, &c., but you will on no account when you cannot trace out offenders conceal a murder and report it as an accidental death.

6*th*.—You will try and induce those Garrows who at one time acknowledged the sovereignty to the British Government, but who have thrown off their allegiance to submit and to pay their Nuzzuranah as heretofore.

(True Copy,)

A. C. Campbell,

Personal Asst. to Commr. of Assam.

From the Hon'ble A. Eden, Secretary to the Government of Bengal, to the Commissioner of Assam,—(No. 342T., dated on board the Yacht *Rhotas*, the 12th July 1865.)

I am directed to acknowledge the receipt of your letter No. 94, dated 11th May 1865, with its enclosure, No. 15G., dated 6th idem, from the Deputy Commissioner of Gowalparah, giving a condensed report of his late tour on the Garrow Frontier, and submitting certain suggestions for the introduction, into the Hills, of a rough system of Police, and in reply to observe as follows.

2. The arrangements proposed by Captain Morton may be thus stated :—

(a) The creation of the Office of *Police Zimmadar*, with a limited civil and criminal jurisdiction, to be held by the Garrow Chiefs; the Lushkars of small contiguous villages being invited to appoint one of their number for the purpose.

(b.) The remuneration of the Chiefs so appointed on the scale mentioned on the margin in return for the performance of their Police functions and apart from any considerations arising from the revenue demand on the part of Government.

Vide Gazette, page 400.

(c.) The grant to each Zimmadar of an Amalnamah in the form submitted with a baton of office. The former to be engrossed on paper of uniform size with gilt edges.

(d.) The investment of office and the presentation of the Amalnamahs by the Deputy Commissioner under Escort of a small Detachment; the Chiefs being invited to attend the ceremony and feasted at the expense of Government.

3. The Lieutenant-Governor approves of Captain Morton's proceedings and sanctions the foregoing arrangements ; but I am directed to observe that the term *Zimmindar* which you use in your letter would be most inappropriate to the office which it is intended to create, the proper title to use is *Zimmadar*.

4. The Lieutenant-Governor also approves of your proposal to vest these Garrow Zimmadars with the same powers with which the Jynteah Dolloyes are vested in regard to trivial offences.

5. With reference to the 2nd and 3rd paragraphs of your letter, I am instructed to inform you that Mr. Driberg will resume his duties at Gowalparah on his return from leave. The inconvenience arising from the want of Assistants with full powers will be separately treated of in reply to your No. 183, dated the 22nd ultimo.

6. In conclusion, I am to request you will convey to Captain Morton the Lieutenant-Governor's commendation of his interesting Report. It will be published in the Supplement to the next issue of the *Calcutta Gazette*.

Printed by Thomas Jones, at the Bengal Secretariat Office.

No. 30.] [405]

SUPPLEMENT TO

The Calcutta Gazette.

WEDNESDAY, AUGUST 23, 1865.

OFFICIAL PAPERS.

A SUPPLEMENT *to the* GAZETTE *will henceforward be published, containing such Official Papers and Information as the Government of Bengal may deem to be of interest to the Public, and such as may usefully be made known.*

Non-Subscribers to the GAZETTE *may receive the* SUPPLEMENT *separately on a payment of six Rupees per annum if delivered in Calcutta, or twelve Rupees if sent by Post.*

No Official Orders or Notifications, the publication of which in the GAZETTE *is required by Law, or which it has been customary to publish in the* GAZETTE, *will be included in the* SUPPLEMENT. *For such Orders and Notifications the body of the* GAZETTE *must be looked to as heretofore.*

Correspondence regarding Epidemic Fever in some of the Districts of Bengal, (continued from the Supplement of the 3rd August 1865.)

From LIEUTENANT-COLONEL J. P. BEADLE, R. E., Secretary to the Government of Bengal in the Public Works Department,—(No. 3337, dated the 6th July 1864.)

COPY of the Memorandum by the Chief Engineer, and of the following Resolution, forwarded to the Secretary to the Government of Bengal for information.

Extracts from the Proceedings of the Lieutenant-Governor of Bengal in the Public Works Department,—(No. 3336, dated the 6th July 1864.)

READ a Memorandum from the Junior Secretary to the Government of Bengal, No. 1933, dated the 18th April 1864, forwarding, for consideration, a copy of a letter from the President of the Commission appointed to enquire into the probable causes which may have produced and strengthened the fevers that have caused so much mortality in the Districts of Hooghly, Burdwan, Nuddea, Jessore, and the 24-Pergunnahs, together with a copy of the Report of the Commission.

Read a Memorandum by the Chief Engineer to the Government of Bengal in the Public Works Department, dated the 27th April 1864, on the Report above referred to.

RESOLUTION.—A Special Engineer (or two Engineers, if their services can be obtained, one for each side of the Hooghly River) should be appointed to take observations and sections of the country affected by the epidemic, for the purpose of ascertaining whether the drainage of the country is affected by the embanked formations of the Railways or of the District Roads, and of the feeders to the Railways, or by any other obstructions, and to report what can be done to correct such evils by the construction of culverts, by clearing channels, filling up holes, removing obstructions, or otherwise.

2. It will be better to employ special Officers for the purpose than to entrust the duty to any Officers who have other duties to attend to.

3. The Officers appointed should, after examining the country during the present rains and collecting all necessary information, submit a full report on the drainage of the country, with a general scheme for its improvement and rectification where required.

4. They should at the same time bring to the notice of the Commissioners of the Nuddea and Burdwan Divisions any particular works which can be undertaken at once with manifest benefit to the health of any particular locality, such as the filling up or the digging of a tank, or the clearing out of a khal, and the Commissioner may be authorised to undertake any such work, provided that half the work is done, or half the expense of the estimate is undertaken by the Zemindars and Villagers. The other moiety will be provided out of the "Amalgamated District Roads' Fund."

ORDERS.—Ordered, that the Memorandum by the Chief Engineer be recorded; that the Chief Engineer be directed to nominate two Engineers to be placed, respectively, at the disposal of the Commissioner of Nuddea and of the Burdwan Divisions for the duties above indicated; and that a copy of the Chief Engineer's Memorandum and of this Resolution be sent to the Secretary to the Government of Bengal, and also to the Commissioners of the Nuddea and Burdwan Divisions, for information and guidance.

Memorandum by LIEUTENANT-COLONEL J. P. BEADLE, R. E., Chief Engineer, Bengal, on the Report of the Commission for investigating the probable causes of the Fevers which have so fiercely raged in the Districts north of Calcutta,—(dated the 27th April 1864.)

ANY private embankment (or dam) which obstructs the *beneficial* drainage of the country can be removed under the law by a Superintendent of Embankments.

The Penal Code gives general powers for treating nuisances which endanger life and property.

Act III. of 1864 if put in force for villages would allow of all necessary improvements being made, and would provide funds for the purpose

from rates and taxes. The power, therefore, exists for carrying out improvements, and it would be well to get in advance of the sickness and to improve places which are in the line of its progress before disease breaks out

How can a fair start be made? And in which way can we best co-operate with the Civil Power? The 52nd and 55th paragraphs of the report state the first practical remedies to be furnished, and the works required to carry them out.

Act III. must be applied to allow of these improvements being made, and the Executive Engineer is an ex-officio Commissioner under the Act.

II.—Polluted drinking water.

III.—Vitiated air and deficient ventilation can be removed by the Municipal Commissioners appointed.

(I) Miasm has to be reduced, and the 48th paragraph attributes the magnitude of this evil to the obstructed drainage and to the gradual silting up of rivers and khals and the general assimilation of levels. The Commission say that "there is still everywhere a sufficient inequality of level to admit of the surface water being quickly and effectually carried off if the natural fall of the ground be judiciously assisted by artificial means."

And that "the obvious course" to effect the reduction of the supply of miasm "is to improve the drainage of the country."

Now, here it would seem that the Department Public Works should assist with its agency, and that all dams obstructing the beneficial drainage of the country should be removed under the Embankment Act and every facility be given for the rapid drainage of the surface of the country; where, however, the cultivation is rice, and where the object of the cultivator is to keep a few inches of water standing in each field which is embanked for the purpose, our operations would not be very welcome if we attempted to drain the surface of the country, and all that we should be allowed to carry off would be the surplus water which is not required for the rice fields.

Ordinarily, villages do not stand on ground which is liable to be inundated, and where there are inundations the volume of water forces its way in some favorable line and makes a channel for itself; something may be done, perhaps, in filling up the holes and hollows in such channels and in old abandoned channels, but the work could only be done on a limited scale and where the holes or hollows are small.

Miasm does not travel far and very little obstructs it, so that this work need only at first be carried out in the vicinity of villages which, situated as they are generally on the bank of a river or on the side of a khal in connexion with a river, should be drained by a cut into the river or into the khal, the khal head being kept clear and open to the river. It is possible that the river will silt up such cuts at the head, making their excavations necessary every now and then. Almost all the khals thus entering the Hooghly above Calcutta have been more or less raised, diminishing their usefulness. Baboo Degumber Mitter connects very directly the sickness which has attacked certain villages, which he names, with the drainage of the country obstructed by the Railways and feeder roads. Extracts from his Memorandum, Appendix No. II., should be sent to the Consulting Engineer, Superintending Engineer, and Commissioner concerned for enquiry and report. I do not myself place much confidence in his remarks, but doubtless the enquiry will lead to some good; for, if the water does lodge and stand alongside these formations, the side channels should be connected with the water-courses and steps be taken for promoting the more rapid drainage of the lands.

It will be well to have a statement framed of the new roads made and making, shewing their height, the fall of the country, and the number of openings, with area of waterway afforded and how distributed. A particular letter will be written upon this subject to the Superintending Engineers, and their attention will be called to this Report of the Commission, to the removal of obstructions to the drainage, and to the measures which may be taken to promote a more rapid drainage of the country.

From LIEUTENANT-COLONEL J. P. BEADLE, R. E., Secretary to the Government of Bengal in the Public Works Department,—(No. 4143, dated the 22nd August 1864.)

COPY of the following Memorandum forwarded to the Secretary to the Government of Bengal for information in continuation of the communication from this Office No. 3337, dated the 6th ultimo, with a request that Lieutenant Hills' services may be made available for this duty, His Honor the Lieutenant having approved of the arrangement.

Memorandum from LIEUTENANT-COLONEL J. P. BEADLE, R. E., Chief Engineer, Bengal,—(No. 951, dated the 22nd August 1864.)

To carry out the orders conveyed in the Proceedings of the Government of Bengal, Public Works Department, No. 3336, dated the 6th July 1864, the Chief Engineer has selected Lieutenant A. Hills, R. E., and Mr. C. Ducas, C. E., to take up at once the special temporary duties connected with the sanitary improvement of the Districts affected by the Epidemic; the former for the Nuddea Division, and the latter for the Burdwan Division.

2. These Officers will be directed to report themselves to the Commissioner of the respective Divisions, and to consider themselves, whilst employed on this duty, as being under the immediate orders of the Commissioners of Divisions; but in all minor matters they will communicate directly with the several Local Civil Officers, who will be instructed by the Commissioner to afford such aid as my be in their power.

3. The Superintending Engineers will afford such general aid and advice to the Commissioners and to the Executive Engineers as may be required in furtherance of the general object in view.

4. The general duties of these special Engineers are laid down in the 1st, 3rd, and 4th paragraphs of the Reselution of the Public Works Department above referred to. Such Establishments as are required to assist in taking levels, or in supervising such works as are undertaken, may be employed under the authority of the Commissioner of Divisions.

5. The submission of the full report and general scheme referred to in paragraph 3 of the Proceedings should not be allowed to interfere with the carrying out of any particular works which it may appear to the Commisioner to be desirable to effect at once; and the special Engineers are to proceed forthwith to those places where the Epidemic is shewing itself, and in the directions in which it

appears likely to advance, reporting to the Commissioner any precautionary measures which it might be advantageous to take.

6. It should be understood that the proceedings of the Engineers must be conducted with the greatest caution, and in communication with the heads of villages, explaining the object of Government in taking these steps, and that it is necessary that every village should be visited and treated separately, as well as that the sanitary improvement of the District generally should be attendedto.

From H. L. DAMPIER, Esq., Commissioner of the Nuddea Division, to the Secretary to the Government of Bengal,—(No. 49Ct., dated the 18th March 1865.)

I HAVE the honor to submit, for the information of His Honor the Lieutenant-Governor, copy of Lieutenant Hills' final Report on his operations while on special duty in this Division in connection with the Epidemic.

2. The first eight paragraphs require no remarks; they refer to points which have been constantly brought forward and discussed.

3. In the 9th paragraph Lieutenant Hills expresses his opinion against a general system of drainage embracing a large area, and recommends drainage by village systems. While he was engaged in visiting the villages, Lieutenant Hills sent me weekly reports containing his suggestions village by village; these were forwarded to the Magistrates with the necessary instructions, or to the Superintending Engineer, according to the nature of the measures recommended, and I am expecting reports of what has been done on them.

4. In the 10th paragraph general suggestions are made for the drainage of parts of the country on a more extended scale. I had hoped that the result of the appointment of a special Engineer Officer would have been a number of well considered and detailed schemes for draining those tracts on which there was reason to believe that the want of such operations was seriously affecting the public health.

5. Special mention is made of the Moolajore drainage. Orders have just been communicated to the Superintending Engineer to carry out the drainage improvements there which have been decided upon.

6. Lieutenant Hills' detailed recommendations as to the Katalparah drainage were communicated to the Superintending Engineer with a view to their being carried out by the Executive Engineer.

7. Copy of Lieutenant Hills' 11th paragraph has been communicated to the Superintending Engineer, with a request that he will take into consideration whether some general instructions cannot be issued which shall secure that proper attention to the drainage of the country by the side drains of roads when they are under construction: the subject seems to me to be of general importance.

8. Lieutenant Hills' scheme for improving the beds of the Bejoy Khal and Unjuna River at Kishnaghur is now in the hands of the Superintending Engineer, who has had the necessary levels taken and surveys made.

9. Meherpore has been free from the Epidemic this season. Lieutenant Hills writes that "some steps ought to be taken to re-open the portion of the silted up channel communicating with the main river, which would be a great boon to the whole of the District watered by the Bhyrub." The advantages which would result are self apparent; but it was to the appointment of a special Officer who could give his undivided attention to the subject that I looked for a detailed scheme for carrying out such works.

10. Lieutenant Hills' remarks regarding the rapid silting up of the Bagaree Khal at Kanchrapara have been submitted to the Superintending Engineer for his consideration and opinion as to whether any, and what, measures are desirable.

11. I annex copy of the general instructions which I issued for Lieutenant Hills' guidance when he first joined his special appointment. He has fully carried out that part which relates to making immediate suggestions for local improvements as he visited the different villages. But the necessity which arose for his sudden transfer has prevented his furnishing the more comprehensive professional scheme, which I hoped to obtain for the general improvement of the drainage of the country by such measures as re-opening the silted mouths of khals and increasing the flow of water in sluggish rivers, or improving their half-dry beds.

From LIEUTENANT G. S. HILLS, R. E., Executive Engineer, Shillong Division, on Special Duty, to H. L. DAMPIER, Esq., Commissioner of the Nuddea Division,—(dated the 31st December 1864.)

I HAVE the honor to forward a general report of my tour of inspection in the Epidemic District with the general suggestions I have to make on the subject.

2. I proceeded from Calcutta to Kishnaghur and Meherpore, inspecting most of the villages of any importance situated between the rivers and the Railway. While on my tour I submitted weekly reports to you, which will necessaraly curtail this one.

3. The more I saw of the District the less competent did I feel to determine upon any *one* particular cause for this dreadful scourge. Many of the better class of Natives affirm that, owing to some unknown or indescribable agency, the atmosphere has become tainted with some malaria, of which all the victims were sensible, as it seemed to strike them with a chill a day or two previous to any attack of fever. I myself noticed, and especially in those villages recently attacked, that a hot steamy heavy atmosphere seemed to pervade the village, the nauseating and depressing effects of which were almost intolerable. I also experienced a cold chilly feeling creep over me in spite of the hot close atmosphere in the village, and I always felt a sensation of relief and freedom on issuing from the village into the open maidan. This sensation, in my case, however, was never followed by any pernicious effects, which may be attributed to taking quinine daily, and sleeping either in a boat, or at some distance from the villages. This inference is further strengthened by the fact, that my syces were the only servants that suffered from the Epidemic, and they alone slept in the villages.

4 The freaks of the Epidemic on its course are also inexplicable, as for instance it broke out, I am led to suppose, almost simultaneously in Santipore and Chogdah and devastated these villages, while it entirely avoided all the rest of the villages on the river bank between them until last year, when it appeard at Haroodham, Bijpore, and many other villages situated on high land with tolerable ventilation. Jugpore, a small village about two

miles from Chogdah, which, from its low position and general unhealthy appearance, presents a most inviting site for fever, has hitherto escaped. Again it has ravaged Monshapotah, Palparah, and all the villages between Chogdah and Sooksagur, except a small village, Junglepore, which, without any apparent reason, has escaped along with Sooksagur; this village however, lies high and is comparatively free from jungle.

5. The origin of the Epidemic cannot be accounted for, neither can its insiduous advances be arrested, but they can be aggravated by many causes, and molified by certain precautions, which, I believe, would ultimately lead to its entire disappearance. Dr. Elliott, in his Report, has so fully traced the course, and detailed the predisposing causes of the Epidemic, that for me to enter upon them would merely be a repetition; it only remains for me to corroborate his statements and views by my experience. What ought now to be done is to carry out a regular organized system of measures, and enforce the maintenance of them by a Municipal Act after they are once executed, first removing the principal predisposing causes, which would necessarily tend to the extinction of the minor ones.

6. Roads are, I consider, the first great desideratum; they serve a three-fold purpose; they open out passages for a free circulation of air and introduction of light; their drains, if sufficiently large and properly arranged, carry off the surface water and prevent much of that stagnation of water which is such a frightful source of malaria, and which is so prevalent in every village; they open up the communication between the villages, thus allowing more rapid transit for articles which could be reared or cultivated in many villages, but which, from their perishable nature, or from the want of demand for them in the immediate neighbourhood, precludes their introduction. This would lead to the adoption of the second great desideratum, the clearance of the low jungle and the cultivation of the land in the interior and vicinity of the villages.

7. This step, irrespective of being a beneficial one, would amply re pay any one the trouble and expense of clearing and cultivating the land on account of the richness of the soil, which, in most places, must be virgin soil. If the land, as is the case in many instances, is the property of a poor woman or child (the rest of the family having died) who is too poor to raise the means for the cultivation, it might be leased out at a low figure to some enterprizing individual in the village who is anxious to cultivate the land and has the means of doing so. It is perfectly useless, and mere waste of money, to fritter away a few thousand Rupees annually in uprooting jungle, for it only grows up again with re-doubled rankness. In many villages a large area of land was cleared last June and July, and when I inspected the villages in September and October so rapid had the re-growth been, that it was almost impossible to distinguish the lands thus cleared from the rest of the jungle. The plan above recommended is, I believe, the most efficient for removing this baneful nuisance. I may here notice some facts which struck me as being remarkable, but for which I cannot account. I noticed that wherever bamboos were grown, there the sickness seems to have been most prevalent; also that the villages that had suffered most severly were over-grown with a jungle which the Natives called "Noonagatch," it seemingly being the most noxious; the "Bhandy" the next; and the "Bharanda," although it seems to spread most rapidily, the last. Bamboos doubtless are most noxious plants; from the great demand for them of late years their cultivation has been much encouraged and increased fifty-fold. Their cultivation within the precincts of the villages ought to be entirely prohibited, or at any rate permitted only to a very limited extent; plots of land at some little distance from the villages ought to be expressly reserved for their cultivation.

8. A good and abundant supply of water is perhaps the next requisite; but such is the apathy and natural laziness of the Native that, even in villages on the banks of the river, in many cases they prefer drinking the filthy water from their foul tanks to taking the trouble of going to the river for good water. Some tanks conveniently situated, chosen by a Committee of the influential men in the village, ought to be reserved entirely for drinking purposes, and any one using them for any other purpose ought to be severely fined. The banks of these tanks ought to be properly sloped and turfed, kept free from trees, jungle, and weeds, and bunded round to prevent general drainage into them. In many instances, at the urgent appeal of the villagers, the landowners have, at their own expense, dug large tanks; these, through the carelessness of the villagers, have been allowed to become as foul and rotten as the rest of the tanks, and from their size they are even more obnoxious. To force the owners to re-dig them would be very hard and unjust; they ought to be repaired and kept on a wholesome state at the expense of the village. To urge the necessity of filling the holes—cesspools, I may say— with which all the villages are honey-combed, is a subject that requires no comment.

9. The last, and by no means the least, important predisposing cause of the Epidemic which I shall notice is the drainage of the country. From the scattered position of the villages a system of general drainage, embracing a large area of land, or a number of villages, is not advisable. Each village ought to be drained separately, and as they, as a rule, are built on ground slightly elevated above the surrounding country, their drainage will not be a difficult matter to effect. In my weekly reports, as I inspected the villages, I fully described the plans that I considered the best for the drainage of each village separately. In the smaller villages the side drains of the roads, already proposed, if properly sloped with a few outlets leading to the natural fall of the country ought to be sufficient to carry off all the surface drainages. As these side drains are made at present their utility is entirely mollified by a custom universally adopted over the country, which is as objectionable as it is pernicious. Wherever these drains pass in front of a house the owners, in preference to going to the expense of making a small culvert, damp up the drains, thus converting them into a succession of filthy holes full of stagnant water. In the larger villages a main drain or khal ought to be cut in the most convenient site admitting of a rapid out-fall for the water; if possible, it ought to be dug at some little distance outside the village and all the drainage ought to be conducted to it. This plan has been adopted with very beneficial results at Halleeshuhur, although here again the selfish and callous nature of the Natives is further exemplified. The khal was cut through a succession of very foul tanks

for the purpose of getting rid of them as well as for drainage, but the owners of these tanks have dammed up the khal to a certain extent to retain a sufficient quantity of water in their tanks, to preserve the fish in them, and the other villages are too callous and careless to report the matter or even to raise any objection. This is a most objectionable proceeding; strict measures ought to be enforced to prevent any stoppage or interference with the flow of drainage water.

10. I have carefully inspected the Eastern Bengal Railway and the feeder road from Barrackpore to Kanchrapara, the District on which any evil results could be produced by their embankments. I do not consider that they materially affect the general drainage of the country, neither can they be regarded as a cause of the Epidemic, and do not think they tend even to aggravate its virulence. Allowing for a moment, however, that such was the case, as all the affected villages in this District are on the banks of the river, their drainage could and ought to be directed to the river. The banks of the river are high and the ground slopes inland to a certan distance, consequently the natural drainage is inland into a few large beels, as the Bhirtee and Mothoora Beels. As the water locates in these beels and the surplus flows out both to the east and west, it is evident that these are the lowest levels in the District. During heavy rains, and the rainy season generally, these beels are partially drained to the west, but the greater quantity of the water flows eastward through the Echapore, Katalpara, and Bagaree Khals into the river, and where these khals intesect the Railway and feeder roads their waterway has not been intercepted. Besides the bridges over these khals a number of culverts have been constructed on the Railway quite sufficient, with a very little trouble and expense in drains leading to them, to allow a free passage for the flow of all the minor water-courses, therefore the general drainage is not interfered with by the Railway. Would it not then be simpler and more effective to lead the drainage water of the villages at once into the river instead of allowing it to flow inland, as best it can, for four and a half miles, and then be brought back to the river by a circuitous route? At Moolujore, where a great outcry has been raised about the interference of the drainage, as you are already aware, I took a succession of levels and ascertained from them that the water-shed line was inland, or to the west of the Railway, thus clearly proving that then at any rate this evil was mythical. At Bhatparah the drainage of that portion of the village lying between the Railway and feeder road has doubtless been intercepted, but by opening drains to the Katalpara Khal or to any of the culverts in the vicinity this evil could be remedied at a mere nominal cost. In one or two other places the side-cuttings, being on the borders of the village, are objectionable, but I believe measures are being adopted to drain them; when this is done no further objection can be raised against the Railway.

11. As regards the feeder road the culverts have not been arranged to the greatest advantage, not being sufficiently deep, and the most of them, being choked up with mud, are not very efficient. At Halleeshuhur the road has certainly interfered with the drainage by damming up one of the principal outlets, but it has been re-opened and a culvert is, I believe, in the course of construction on the site. The site drainage of the road is very defective, in fact I may say it is totally ignored, and in most of the side-cuttings the water is allowed to stagnate, no precautions having been taken for their drainage. This doubtless is a source of great evil and one which the Natives complain bitterly; they naturally cannot understand why they should be forced to fill up the small holes which they have dug when those excavated at Government expense are left untouched. If these faults were rectified all grounds for complaint against the feeder road would be removed.

12. At Kishnagur, from the silting up of the Unjona Khal, and the long stagnation of the water in it, a fertile source of malaria has arisen. In my Report on Kishnaghur I have suggested the propriety of deepening the khal and re-opening its communication with the Jellinghee River. At Meherpore also a vast amount of sickness has been caused by silting up of the bed of the Bhoyrub River, which, during the hot weather, is a mere stagnant morass the unhealthiness of which was much increased during the rage of the Epidemic by the number of dead bodies that were thrown into it. To remove this evil some steps ought to be taken to re-open the portion of the silted up channel communicating with the main river, which would be a great boon to the whole of the District watered by the Bhoyrub. In the District in which the ravages of the Epidemic have been most deadly, I do not consider that the argument, that from the silting up of the beds of the khal and beels, and the gradual rise of the river bed, the natural drainage of the country has been affected, holds good. As I have already said, the greater part of the drainage of this District is directed naturally, but indirectly, to the Echapore, Katalpara, and Bagaree Khals, and it is only by the silting up of their beds that the general drainage could be affected. To ascertain if this idea was a fact I had a line of levels taken along the Echapore Canal from its rise in the Bhirtee Beel to its fall into the Hooghly. I also ran lines of levels along the Bagaree Khal from the river to its sources in the Muthoora and Khoola Beels. From the Echapore Section I find that on the 4th of November the high water mark of the river was four feet below the surface of the water in the Bhirtee Beel, and as the length of the khal is four and a half miles there was an ample fall for drainage under any circumstances. The height of the water in the river during the floods in the rains is about ten and a half feet above the high water mark on the 4th of November, while at the same season the inhabitants of the villages on the banks of the beel state that the beel was about eight feet deeper than it was on that date, leaving a rise of two feet in favor of the beel, thus proving that the level of the surface of the water of the river is not, even under adverse circumstances, above that of the inland country. From the Bagaree Khal Section I ascertained that on the 11th November the high water mark of the Hooghly was ten feet below the level of the surface of the water in the Muthoora Beel, and the latter level on that date was only three feet lower than the highest flood line of the Hooghly. The villagers of Kanchrapara and other villages on the banks of the khal state that during the highest floods the effects of the tide is visible on the Muthoora Beel: this I can hardly credit, for it would only admit of a rise of three feet of water in the beel during the rains. Granting, however, that such was the

case, the drainage water that escapes down the khal would only be interrupted for a few hours during one or two months in the year, and this would never sensibly affect the general drainage. The villagers also say that during the last two years the bed of the khal at its mouth has silted up two feet; this is a serious matter and measures ought to be adopted at once to prevent any further slitting up, as it might ultimately tend to interrupt the drainage, but at present there is no cause for fear. I shall submit calculations, as soon as I possibly can, which I hope will prove that if it were necessary; these khals have sufficient waterway to drain a much larger area of ground then they are required to do. Having thus, I hoped, proved that the cause of the Epidemic can neither be traced nor attributed to the roads or general drainage, I shall bring my Report to a close, regretting the delay in forwarding it, which was caused by unavoidable circumstances, inasmuch as immediately on my return to Calcutta after my inspection tour I had to proceed to Assam to take charge of the Shillong Road.

From H. L. DAMPIER, ESQ., Commissioner of the Nuddea Division, to LIEUTENANT G. S. HILLS, R. E., on Special Duty,—(No. 127, dated the 1st September 1864.)

IN continuation of my letter No. 124, dated 29th August, (addressed to you at the Kishnaghur Post Office,) and with reference to your letter dated 25th August, reporting yourself as having entered on the special duties assigned to you by the Chief Engineer's Memorandum No. 951, dated 22nd August, I have the honor to communicate the following remarks:—

2. Your duties are defined in the Resolution of Government, Public Works Department, No. 3336, dated 6th July, and in the Memorandum by the Chief Engineer which is cited above. They are—

1st.—To examine the country during the present rains, to collect all necessary information, and to submit a full professional report on the drainage of the country with a general scheme for its improvement and rectification where required; and this examination and report is to be made with reference to the opinion expressed by the late Committee, and which is widely entertained, that of late the general dampness of the Epidemic tracts has been increased and the natural outlets to the drainage of the country into the rivers gradually obstructed partly by the Railway and road embankments and partly by the natural silting up of the mouths of khals.

2nd.—While you are engaged in making the examinations and collecting the infomation necessary for this general report, you are required to bring to my notice any specific local works (apart from a general system of drainage) which may appear to you to be manifestly required for the sanitary improvement of particular villages, such as the cleaning out of a tank or of a khal, and such works I am authorized to undertake at once, *provided* I can raise a subscription equal to half the estimated cost; and you are required to "proceed forwith to those places where the Epidemic is shewing itself and in the directions in which it is likely to advance, reporting to the Commissioner any precautionary measures" which are desirable.

3rd.—With regard to your operations for the collection of information for a general report on drainage you have already been employed in this part of the country in connexion with the Epidemic, and as the subject is purely professional it is unnecessary for me to suggest the course you should pursue. You will observe that I can sanction your appointing the necessary Establishment for levelling, &c.; you will probably know best how to procure qualified men from the Public Works Department. I request that you will favor me with the outline of the general plan of operations which you propose to adopt.

4th.—As to the special works which you may suggest for immediate execution, I request that each proposition may be accompanied by a rough estimate of the cost. On receipt of these I shall communicate with the Magistrate as to the execution of the work. And in making proposals for such works I hope that you will confine yourself to such as will be attended with "manifest benefit to the health of the locality." All villages are dirty and more or less overgrown with jungle which would be better away and are badly drained; but I look to you to select the more urgent works and those which will tell most on the health of the largest number. If recommendations are so multiplied that it is impossible to carry them all out, obviously the selection of works to be undertaken has to be made by Officers who have never seen the locality, and who, therefore, are not in as favorable a position as you are for judging of the comparative advantages which would result from the different works.

5th.—Oollah and Halleeshuhur are places which you should take an early opportunity of visiting to see how the extensive works which have been done there have lasted and answered.

6th.—Obstruction to the drainage near the Samnuggur Station is a subject on which the Government have called for a report during the rains. I annex copies of the correspondence* on the subject and request a special report.

7th.—As to other localities in which the Epidemic has shewn itself and to which your early attention is desirable, I request that you will communicate and take suggestions from the Magistrates of Nuddea and the 24-Pergunnahs, under whose orders operations are now going on. You will of course assist the Magistrate with any suggestions as to these minor operations which may come under your observations.

8th.—For tents, if required, you will apply to the Magistrates of the 24-Pergunnahs and Nuddea, with whom you will correspond direct on all minor matters.

9th.—Referring to paragraph 6 of the Chief Engineer you will doubtless take every oppotunity of making known to the people the precautionary measures suggested in the Committee's Report, copy of which I annex for your information.

10th.—As arranged between us verbally, you will be good enough to forward to me weekly abstracts of your operations during the past week

* Baboo Prosunno Coomar Tagore's remark on the subject, dated 12th September 1863.
The Order of Government, dated 6th October, No. 1007T.
Mr Smallwood's Report, dated This will be obtained back from Government and forwarded to you.
Order of Government thereon, dated 27th Februaty 1864, No. 1019.

with a note of your intended movements during the coming week.

11*th*.—I request that you will keep yourself in constant communication with the Magistrates of 24-Pergunnahs and Nuddea that you may co-operate with one another.

From S. C. BAYLEY, Esq., Junior Secretary to the Government of Bengal, to the Commissioner of the Nuddea Division,—(No. 178T., dated Bhaugulpore, the 3rd July 1865.)

I AM directed to acknowledge the receipt of your letter No. 49Ct, dated the 18th March last, submitting, with your remarks, a copy of Lieutenant Hills' final report on his operation while on special duty in the Nuddea Division in connexion with the Epidemic.

2. The points noticed in Lieutenant Hills' report which required action appear to have been disposed of by you and the Lieutenant-Governor approves of your proceedings. A copy of your letter and of Lieutenant Hills' report will be published in the Supplement to the *Calcutta Gazette*.

Conduct to be pursued towards Confederate Vessels of War in the Ports of H. M.'s Dominions.

From A. COLVIN, Esq., Officiating Under-Secretary to the Government of India, Foreign Department, to the Secretary to the Government of Bengal,—(No. 577, dated Simla, the 6th July 1865.)

I AM directed to forward, for the information and guidance of His Honor the Lieutenant-Governor, the accompanying copy of a Dispatch from Her Majesty's Secretary of State for India, No. 42, dated 3rd ultimo, on the subject of the conduct to be henceforward pursued towards Confederate Vessels of War in the Ports of Her Majesty's Dominions.

(Copy)

INDIA OFFICE:
London, 3rd June 1865.

POLITICAL,
No. 42.

HIS EXCELLENCY THE RIGHT HON'BLE THE GOVERNOR GENERAL OF INDIA IN COUNCIL.

I TRANSMIT, for the information of your Excellency's Government, copy of a letter received from Her Majesty's Secretary of State for Foreign Affairs on the subject of the conduct to be henceforward pursued towards Confederate Vessels of War in the Ports of Her Majesty's Dominions. I have to direct that the instructions contained in Earl Russell's letter may be fully carried out in all Ports, Harbours, and Waters under your control.

I have, &c.,
(Sd.) C. WOOD.

FOREIGN OFFICE,
The 2nd June 1865.

EARL RUSSELL TO THE LORDS COMMISSIONERS OF THE ADMIRALTY.*

I HAVE the honor to state to your Lordships that since the date of my letter of the 11th ultimo intelligence has reached this country that the late President of the so-called Confederate States has been captured by the Military Forces of the United States, and has been transported as a Prisoner to Fort Monroe, and that the Armies hitherto kept in the field by the Confederate States have for the most part surrendered or dispersed.

In this posture of affairs Her Majesty's Government are of opinion that neutral nations cannot but consider the Civil War, in North America as at an end.

In conformity with this opinion Her Majesty's Government recognize that peace has been restored within the whole territory of which the United States of North America, before the commencement of the Civil War, were in undisturbed possession.

As a necessary consequence of such recognition on the part of Her Majesty's Government, Her Majesty's several Authorities in all Ports, Harbours, and Waters belonging to Her Majesty, whether in the United Kingdom or beyond the Seas, must henceforth refuse permission to any Vessel of War carrying a Confederate flag to enter any such Ports, Harbours, and Waters; and must require any Confederate Vessels of War which, at the time, when these orders reach Her Majesty's Authorities in such Ports, Harbours, and Waters, may have already entered therein on the faith of proclamation heretofore issued by Her Majesty, and which, having complied with the provisions of such Proclamation, may be actually within such Ports, Harbours, and Waters forthwith to depart from them.

But Her Majesty's Government consider that a due regard for national good faith, honor requires that Her Majesty's Authorities should be instructed, as regards any such Confederate Vessels so departing, that they should have the benefit of the prohibition heretofore enforced against pursuit of them within 24 hours by a cruizer of the United States lying at the time within any such Ports, Harbours, and Waters, and that such prohibition should be then, and for the last time, maintained in their favor.

If, however, the Commander of any Confederate Vessel of War which may be found in Port, Harbour, or Waters of Her Majesty's Dominions at the time these new orders are received by her Majesty's Authorities, or may enter such Port, Harbour, or Waters within a month after these new orders are received, should wish to divest his vessel of her warlike character, and, after disarming her, to remain without a Confederate flag within British Waters, Her Majesty's Authorities may allow the Commander of such Vessel to do so at his own risk in all respects, in which case he should be distinctly apprized that he is to expect no further protection from Her Majesty's Government, except such as he may be entitled to in the ordinary course of the administration of the law in the time of peace.

The rule as to 24 hours would, of course, not be applicable to the case of such vessel.

I have addressed a similar letter to the Secretaries of State for the Home, Colonial, India, and War Offices, and also to the Lords Commissioners of Her Majesty's Treasury, requesting them, as I do your Lordships, to issue instructions in conformity with the decision of Her Majesty's Government to the several British Authorities at home or abroad who may be called upon to act in the matter.

I am, &c.,
(Sd.) RUSSELL.

* Similar letters were addressed to the Colonial Office, War Office Treasury, and India Office.

Report on the Inundation of the Soane in the Shahabad District, in September last.

From J. W. DALRYMPLE, ESQ., Officiating Commissioner of the Patna Division, to the Secretary to the Government of Bengal,—(No. 236, dated the 10th July 1865.)

I HAVE the honor to forward, for the information of Government, a letter, No. 267 of the 5th instant, from the Magistrate of Shahabad, enclosing Reports from the District Superintendent of Police, Major Reay, and the District Engineer, Mr. Macnamara, on the great flood of the Soane, which took place in the Shahabad District in September last.

2. Although much injury was done by this flood to public and private property, and serious fears were entertained for the safety of the Railway Bridges, one of which seems to have had the very narrowest escape, it happily occasioned the loss of only one life.

3. Mr. Macnamara's Report is very full and intersting, and I would recommend its publication.

P. S.—The return of the enclosures is requested.

From J. P. H. WARD, ESQ., Magistrate of Shahabad, to the Officiating Commissioner of the Patna Division,—(No. 267, dated the 5th July 1865.)

I HAVE the honor to forward two Reports drawn up by Major Reay and Mr. Macnamara respecting the inundation of the Soane last year.

2. The Town of Arrah and the surrounding country is subject to periodical inundations of this kind, but unfortunately no record of them has been kept, I therefore thought it advisable to have the result of the present inundation put on record.

3. These reports will shew (1) the height of the flood; (2) the extent of country inundated; (3) the amount of damage occasioned. On these three points I have nothing to add to the details given in the reports.

4. Mr. Macnamara has further touched upon matters of great interest, *viz.*, the sufficiency or non-sufficiency of the waterway allowed along the Railway line of embankment between Arrah and the Soane. It is not for me to advance an opinion one way or another as to the correctness of Mr. Macnamara's conclusions, but he is deserving of credit for having devoted his attention to so important a subject. During the flood the stability of the bridges along this portion of the embankment was a matter of much anxiety.

5. The return of Major Reay's Report, together with the Map shewing the country inundated, when no longer required, is requested.

Report on the late inundation caused by the Soane overflowing.

FROM enquiries made relative to the late flood the from Soane it appears that the inundation was first caused by heavy rain which fell on the plateau of Rhotasghur from 10 P. M. of the 10th September and continued with occasional intermission till 2 P. M. on the 11th.

The flood from the Koel River reached and joining the waters from the plateau caused the Soane to rise. On the 12th the waters of the Kanhar, Keur, and Bijul caused another rise, and on the 13th this was increased by the Gopat and Soane Nullahs, but little damage was done in this District up to Nasreegunge, where the bank are very high; but I hear in the Behar District the property of the Sonpura Raja was destroyed.

The river overflowed its banks at the Village of Behta, but was chiefly confined to the low ground on this bank to the east of the road; again at Undharie but did not cause much damage; at Sahar it did the same damage, and destroyed a the few houses, the flood reached the Villages of Burhooe, Bujreawun, Seota, and Bhagee, where it caused the reservoirs for watering the rice crops (very common in this part of the country) to burst their banks it reached Bergaon and Ahla Villages, skirting Barakuntea and Dehra in the Punwar District, where it fell into the "Koomhurree" or Nugree Nullah and caused the latter to overflow, inundating the whole country in its course, and destroying the crops of Kodos, Juneera, Dal, and Cotton, and breaking down the Kaimnuggur Bridge on the Koel Road.

Again I find the river overflowed its banks at Chilhoos and the northerly end of the (Sandes,) Tircool Bund, Kundool, Burhiyara, Chandee, and Dundeea Villages; the water from these places took a northerly course towards the Ganges, submerging the whole country for many feet and doing great damage.

In the Village of Jumera many houses were destroyed, and the water must have been many feet deep at this spot.

In the Town of Arrah a number of houses have been washed down, and when the flood was at its height the streets in many places were 3 and 4 feet deep. Appended is a list of the villages and portions of the town that have chiefly suffered; the roads and bridges will be reported on by the District Superintendent of Roads, I shall not therefore enter into details on this subject.

I had an opportunity of seeing the flood at its height on the evening of the 14th, and, as far as the eye could reach, the country to the east and south-east of Arrah was under water; it is computed that some 400 square miles to the west of Arrah and past the Railway Station of Behta to the east was inundated as the flood was forced up.

Mr. Davies, of Rhotasghur, from whom I obtained my information as to the fall of rain on the plateau, states that on the 24th June 1848 the Soane in its neighbourhood was 1 foot higher, in which year Arrah, I believe, suffered considerably, but much more about thirty years ago. Had the Ganges not been low I am of opinion that the greater portion of the Town of Arrah would have been destroyed.

The Soane was higher last year at the Bridge by 2 inches, but that measurement would have been exceeded this season had not a large body of water escaped by another channel.

No truthful estimate could possibly be formed of the value of the crops destroyed, as the Returns would be greatly exaggerated by the owners in the hope of some compensation.

Strange to say, I have only heard of one life being lost in the flood and even few cattle; this may be accunted for by the unusually bright moonlight nights and general fine weather, which enabled the sufferers to steer clear of dangers.

A rough calculation has since this been made of the area of crops injured and probable damage done, *viz.*, 2,269 beegahs, and valued at Rupees 12,757.

C. REAY.